REPORT RESUMES

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EDUCATIONAL MEDIA IN VOCATIONAL AND TECHNICAL EDUCATION, A REPORT OF A NATIONAL SEMINAR.

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ONE HUNDRED AND FIFTY-FOUR PARTICIPANTS, INCLUDING STATE DEPARTMENT OF EDUCATION SUPERVISORS AND CONSULTANTS, SPECIALISTS AND TEACHER EDUCATORS FROM ALL SERVICES OF VOCATIONAL AND TECHNICAL EDUCATION REPRESENTING 31 STATES AND CANADA, ATTENDED THE SEMINAR WHICH HAD THE PURPOSES OF (1) INFORMING PARTICIPANTS OF THE MANY NEW DEVELOPMENTS IN EDUCATIONAL MEDIA PROVIDING CRITERIA FOR THEIR EVALUATION, DISCLOSING THEIR CAPABILITIES, AND PRESENTING EXEMPLARY APPLICATIONS TO INSTRUCTIONAL PROBLEMS, AND (2) STIMULATING AND DIRECTING SMALL DISCUSSION GROUPS IN ORDER TO ELICIT SUGGESTED APPLICATIONS TO VOCATIONAL AND TECHNICAL EDUCATION. MAJOR SPEECHES WERE--(1) "THE IMPORTANCE OF THE SEMINAR" BY R. TAYLOR, (2) "THE CHALLENGE FOR CHANGE IN VOCATIONAL AND TECHNICAL EDUCATION" BY D. BUSHNELL, (3) "LEARNING THEORY, MEDIA OF INSTRUCTION, AND VOCATIONAL EDUCATION" BY L. BRIGGS, (4) "EDUCATIONAL OBJECTIVES--FOUR DOMAINS" BY E. SIMPSON, AND (5) "THE LEARNING SYSTEMS APPROACH TO INSTRUCTION AND THE CHANGING ROLE OF THE INSTRUCTOR" BY D. STEWART, (6) "THE LEARNING RESOURCE CENTER AND THE CHANGING EMPHASIS IN EDUCATION" BY M. SHERMAN, (7) "THE USE OF MULTI-MEDIA IN SCIENCE EDUCATION" BY S. POSTLETHWAIT, (8) "ON NARROWING THE CREDIBILITY GAP FOR THE CAI" BY H. MITZEL, (9) "CURRENT GUIDANCE APPLICATIONS OF COMPUTERS" BY J. IMPELLITTERI, (10) "A SMALL COMPUTER FOR USE IN TEACHING COMPUTER FUNDAMENTALS" BY J. BENNETT, (11) "MICRO-TEACHING" BY D. ALLEN, (12) "LOW-COST OVERHEAD TRANSPARENCY PRODUCTION" BY A. JENSEN, (13) "MEDIA FOR LARGE GROUP INSTRUCTION IN CHEMISTRY" BY W. LIPPINCOTT AND W. BARNARD, AND (14) "EDUCATIONAL MEDIA HARDWARE FOR LARGE GROUP INSTRUCTION" BY W. BARNARD. REPORTS OF TWO PANEL REACTION AND 19 INTEREST GROUP SESSIONS ARE INCLUDED. THE SEMINAR AND THE REPORT PROVIDE A GUIDE FOR STATES TO SPONSOR STATE-LEVEL SEMINARS ON THE APPLICATIONS OF EDUCATIONAL MEDIA TO VOCATIONAL AND TECHNICAL EDUCATION. (HC)

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EDUCATIONAL MEDIA IN VOCATIONAL AND TECHNICAL EDUCATION

COTRELL

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The Center for Vocational and Technical Education has been established as an independent unit on The Ohio State University campus with a grant from the Division of Adult and Vocational Research, U. S. Office of Education. It serves a catalytic role in establishing a consortium to focus on relevant problems in vocational and technical education. The Center is comprehensive in its commitment and responsibility, multidisciplinary in its approach, and interinstitutional in its program.

The major objectives of The Center follow:

1. To provide continuing reappraisal of the role and function of vocational and technical education in our democratic society;
2. To stimulate and strengthen state, regional, and national programs of applied research and development directed toward the solution of pressing problems in vocational and technical education;
3. To encourage the development of research to improve vocational and technical education in institutions of higher education and other appropriate settings;
4. To conduct research studies directed toward the development of new knowledge and new applications of existing knowledge in vocational and technical education;
5. To upgrade vocational education leadership (state supervisors, teacher educators, research specialists, and others) through an advanced study and in-service education program;
6. To provide a national information retrieval, storage, and dissemination system for vocational and technical education linked with the Educational Research Information Center located in the U. S. Office of Education;
7. To provide educational opportunities for individuals contemplating foreign assignments and for leaders from other countries responsible for leadership in vocational and technical education.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Leadership Series, No. 14

EDUCATIONAL MEDIA IN VOCATIONAL AND TECHNICAL EDUCATION

A REPORT OF A NATIONAL SEMINAR

Edited by

CALVIN J. COTRELL
EDWARD F. HAUCK

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The Center for Research and Leadership Development
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1967

PREFACE

During the week of August 7-11, 1967, 154 State Department of Education supervisors and consultants, specialists and teacher educators from all services of vocational and technical education convened in Columbus, Ohio for a National Seminar on "Applications of Educational Media in Vocational and Technical Education." The seminar, which included participants from 31 states and Canada, was sponsored by The Center for Vocational and Technical Education.

The major purposes of the seminar were: to inform participants of the many new developments in educational media; to provide criteria for evaluation of media; to disclose the capabilities of this media; to present exemplary applications to instructional problems; and to stimulate and direct small discussion groups in order to elicit suggested applications to vocational and technical education.

We trust that the seminar and this report will provide a guide for states to sponsor state-level seminars on the applications of educational media to vocational and technical education.

Recognition is due Dr. Calvin J. Cotrell, Seminar Director, and Mr. Edward Hauck and Mrs. Mary Montei who served as seminar coordinators. We also acknowledge the assistance of Dr. Harry Huffman, Specialist in Business and Office Education, and Dr. Edward J. Morrison, Research Coordinator, both on The Center staff, who served as reviewers for the document.

Robert E. Taylor
Director

INTRODUCTION

The materials contained in this publication consist of presenters' papers and interest group session reports. Each interest group report was prepared by the chairman of the group; the consultant served as a presenter, demonstrator, and/or as a resource person in order to react to questions from the participants.

The reader will note that where a presentation was made in a general session, the interest group report follows the presenter's paper. Where no general session presentation was made, the interest group presentation and discussion are presented as a single unit. To conserve space and avoid duplication, interest group reports on the same topics have been combined. It should be noted that the interest group reports do not always follow a consistent format. When possible, the interest group chairman summarized the main concepts of a presentation or described a demonstration--when a demonstration was made; directed the participants in a discussion of the advantages and disadvantages of the medium or system; lead the group in a consideration of the value of the medium or system for administration, supervision, teacher education, and instruction; elicited suggestions for applications of the medium or system to vocational and technical education; and encouraged the participants to define the facilities implications of the medium or system. Because of diversity of the proceedings and content of the interest group sessions, consistency of the reports often had to be relinquished in order to preserve the integrity of the contributions.

This report is divided into four parts. Part I--The New Media Challenge in Vocational and Technical Education--contains those presentations which set forth the purposes for the seminar; Part II--Educational Media and the Instructional Task--incorporates the materials which, basically, associate educational media with the instructional task; Part III--The Changing Emphases in Education and the New Media--contains materials which describe and suggest applications of educational media or systems; Part IV--Implementing Action--attempts to present a representative sample of synthesized statements about the applications of educational media to vocational and technical education field tasks. The Appendix includes a listing of seminar participants, consultants, exhibitors, planning consultants, planning committee, and seminar staff. A description of a series of communication films, viewed during the seminar, is also appended. The films document the problems of mass communication, classroom communication, and intercultural understanding. They demonstrate current uses of the new educational technology in school administration, teacher-training programs, and classroom situations. This same technology is seen in governmental, industrial, and professional settings.

The views and suggestions contained within the report represent the opinions of the presenters and the participants, and in editing, we have attempted to preserve those viewpoints. While the materials contained in this publication have been developed with great care, it should be mentioned that some of the papers were prepared from tape recordings and recorders' notes and are, therefore, subject to transcription error.

The seminar theme--Applications of Educational Media in Vocational and Technical Education--was developed, to a large extent, by the seminar participants during interest group sessions. The suggested applications in Part III are intended to be representative rather than inclusive; that is, each suggested application is recognized as a type of instructional task. The reader is invited to develop his own applications by selecting analogous instructional tasks from his field, e.g., the computer has been used to simulate farm management problems; therefore, it could be used to simulate food-service management problems, machine shop management problems, or food-marketing management problems.

It is with our sincere gratitude that we acknowledge the important contributions of Drs. James W. Hensel and Aaron J. Miller of The Center who served as chairmen of daily sessions, the project staff, Center personnel who conducted interest group sessions, and those who assisted with the preparation of this report.

C. J. Cotrell
Edward Hauck

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EDUCATIONAL MEDIA IN VOCATIONAL AND TECHNICAL EDUCATION

A REPORT OF A NATIONAL SEMINAR

PART I - THE NEW MEDIA CHALLENGE IN VOCATIONAL AND TECHNICAL EDUCATION

THE IMPORTANCE OF THE SEMINAR

Robert E. Taylor[1]

On behalf of my colleagues at The Center and the University administration, I would like to welcome you to this National Seminar on Educational Media in Vocational and Technical Education. We are pleased that 154 leaders in this field from 31 states and Canada share our concern in this vital topic. I would like to commend Dr. Cotrell and members of the committee and his supporting staff for their planning and arrangements for this meeting.

For those of you whose attendance at this meeting may provide your first involvement with The Center, I would like to share with you some brief background information on The Center.

The Center is organized as an independent unit on the campus of The Ohio State University and relates to a wide range of departments and colleges. As Director of The Center, I report to the Provost of the University, Dr. John Corbally.

Our staffing pattern includes personnel from the several areas of vocational and technical education and the behavioral sciences. The staff includes individuals in the field of information and library science. Research associates who are pursuing their doctoral program make an important part of our organization. We are also appreciative of the high level performance of our technical and supporting staff that complements our senior research and development specialists.

In essence, The Center is comprehensive in its commitment and responsibilities to the total field of vocational and technical education, is multi-disciplinary in its approach to significant problems impacting on this area, and is interinstitutional in its program.

Our major thrusts are in research, development, leadership training (state level) and dissemination. An important component of The Center is the ERIC Clearinghouse for Vocational and Technical Education. This is one of 18 clearinghouses, each representing a substantive area of education, that are linked to the National Information Retrieval and Dissemination System developed by the U. S. Office of Education. In addition to forwarding abstracts to Research in Education, our clearinghouse also produces two quarterly publications, Abstracts of Instructional Materials in Vocational and Technical Education (AIM) and Abstracts of Research and Related Material in Vocational and Technical Education (ARM).

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[1] Dr. Taylor is director, The Center for Vocational and Technical Education, The Ohio State University.

You will be interested to learn that to date over 2,700 state and national leaders in various areas of vocational and technical education and supporting fields from 50 state departments of education and representing over 200 institutions of higher education have participated in leadership development seminars, research planning, and similar meetings sponsored by The Center.

Our staff is anxiously looking forward to moving into the building addition that will make available another 20,000 square feet for our use. The new building will include conference and seminar rooms, and information retrieval, data processing, and educational media laboratories in addition to needed offices and other facilities.

While you have already indicated, by your presence, the importance of this seminar topic, I would like to take a few moments to reinforce the timeliness and significance of this seminar on educational media.

Recent developments have placed increased emphasis on the need for vocational and technical education to adequately and successfully exploit applications of media in maximizing efficiency in learning. Many of these factors are well known to us, but let me review them quickly as we attempt to set the stage for optimizing our time together. First, there is increased emphasis on behaviorally oriented objectives.

Second, we are giving increased attention to the individualization of learning. We are recognizing needed flexibility and adaptability to provide individualized instruction. We are becoming increasingly aware of the need to help students become self-actuated learners, making proficient self-diagnosis and taking corrective measures to improve their learning. Thus, attention is shifting from the importance of teaching to increased emphasis on the importance of learning.

Third, we are witnessing increased emphasis on instructional systems in vocational and technical education which assigns a prominent role to multi-media. This emphasis recognizes that it takes more than a teacher, or a curriculum, or a classroom, or combination of these three to provide an effective educational program. Further, it emphasizes the importance of recognizing the many avenues for learning and reinforcement and takes into account the total milieu for the teaching-learning process and the "system" needed to effectively actuate this.

Fourth, there is growing recognition that education is a continuous process. This points out the need for individuals to become life-long students and reinforces the importance of their learning more about learning as it applies to them individually. Further, students need to be helped in becoming self-directing learners--to ultimately perform effectively as citizens and economic contributors. These concepts place increased responsibility on individual students to take advantage of self-study opportunities that will become available through further applications of media.

Fifth, media are becoming increasingly recognized as educational essentials--not as frills. Further, they are recognized as supplementing effective instruction--not supplanting the teacher.

Finally, optimal applications of media promise a viable means of improving educational and economic efficiency in the learning process.

There are other factors we could mention which impinge equally on our topic today; however, time and circumstance do not permit their discussion. Perhaps the factors that I have mentioned are sufficient to underscore the importance of the seminar and the purposes that have brought us together for extending our understanding and competence in this critical area.

In closing, I would like to say that we have a vital purpose for our seminar. With the nationally recognized consultants, the resources of The Center, the educational media hardware and software assembled here, and your participation and vital perspective, I predict a successful seminar.

THE CHALLENGE FOR CHANGE IN VOCATIONAL AND TECHNICAL EDUCATION

David S. Bushnell[1]

The fact that we have in this country such a mobile population--one that is moving from the rural setting into the urban setting--requires a very different approach to education and training from that which we thought was adequate before World War II. But these changes are taking place so rapidly that most of our schools are educating young people with only the vaguest of ideas about the nature of the work those students will face a decade from now. Yet this education given to our young people must serve them for five or six decades in the future. To adapt our schools to the technical advances and the social complexities that are in vogue and will continue to take place, we obviously have to adapt our curriculum and instructional materials.

Many of these new materials, new approaches in math, physics, social studies, are geared to what has been called the "discovery process." I do not believe that this is too new to the experienced vocational educator. Many of the techniques and the attitudes that the educator has as a teacher are geared just to that need of serving the student in such a way that the student can discover for himself the excitement and the reward involved in occupational and vocational preparation. The students are permitted, in many of these courses, to discover things for themselves--both the basic laws and principles and the skills underlying a particular discipline. There is less demand for memorizing and rote learning. More of the curriculum today is being geared to learning how to learn.

These developments in curriculum--geared to the special needs of students, such as slow learners, gifted children, or culturally deprived--are ones that the Office of Education has been very much concerned with. In fact, some 28 million dollars in the last six years has been invested in developing new curriculum, new instructional methods and techniques for overcoming our inabilities in the past to relate effectively to these students of varying backgrounds, abilities, and interests. It is the new instructional technology which, I think, offers an important tool for providing the scope, the depth, and the diversity of learning experience which has not, up to now, been really possible. I want to mention to you just one effort in depth and then perhaps to hit a few of the highlights of seemingly promising developments in the near future.

---

[1] Mr. Bushnell is the director, Division of Comprehensive and Vocational Education Research, Bureau of Research, U. S. Office of Education, Department of Health, Education, and Welfare, Washington, D. C.

One of the most important outcomes of educational research in the last decade is the promise that it will soon be possible to provide a truly individualized education for each child by techniques that are not only now economically feasible for use in schools but capable of being adapted readily by present-day teachers. The benefits of individualized learning are as important for the average or the gifted child as they are for the slow child. The gifted no longer needs to be held back in some artificial average pace; the slow child need not experience the frustration of trying to keep up; and even our so-called average child has strengths and weaknesses that can be coped with by individualizing instruction. In other words, the individualized learning system dispenses with the necessity and often the stigma of dividing classes into two, three or four separate tracks. Each child is given a chance to experience challenge and success by working in his own individual track.

One of the first full-scale operational demonstrations of this application was in a local school in Pittsburgh. I am sure you have heard of the Oakleaf Elementary School in suburban Pittsburgh. It is serving as a laboratory for The University of Pittsburgh--our Center for Development Studies--where experiments with instructional systems are being carried out which are likely to point the way for many schools in the future. Under this individually prescribed instruction, each child proceeds at his own pace under the guidance of teachers who prescribe lessons for him based on information gathered from placement tests, pre-tests, curriculum-embedded tests, and post-tests. Students spend one half of each school day delving into reading, mathematics, and science, from programs prescribed for them by their teachers on the basis of the diagnostic tests. The students' prescriptions may include tutoring or group activities, as well as individualized self-study material.

Essentially, this instructional system is based upon carefully sequenced and detailed objectives described in terms of behaviors for all the desired outcomes of instruction. Instructional materials are geared exactly to the stated objectives and are designed to permit each pupil to proceed, quite independently, with a minimum of direct teacher intervention. The system provides for detailed diagnosis of the pupil's skill based on constant monitoring of progress. Written prescriptions are prepared to meet individual needs and interests. The teacher, freed from many of the conventional classroom responsibilities, is much more able to serve the tutorial role for which I think the teacher is uniquely qualified.

Many of the students at Oakleaf are performing from two to four year grade levels above what normally is expected of their age. Two youngsters at the elementary school were taking calculus last year. Visitors to Oakleaf often raise the question as to what secret exists there, and I quote one of the educators at Oakleaf by saying that "Self-directed students provide no discipline problem in an informal atmosphere in which children display a real desire to learn and genuine respect for teachers." I think that little snapshot of what is happening in the Oakleaf School offers some perspective of what may be in the offing for elementary schools and secondary schools throughout the country.

Let me go back to the topic of the new instructional technology. I think that a number of developments are creating many opportunities for overcoming some of the shortcomings that still exist in our high schools, particularly in our vocational programs. The computer, for example, is offering some promise of serving as an intermediary between employers and school counselors, making possible far better information systems for funneling industry and job needs to curriculum planners in schools. We have been supporting a growing number of sites, one at Harvard, another at the Systems Development Corporation, using computers to adapt information to the particular interests, background, and learning capability of the student. Flexible scheduling--a study in which Dwight Allen, one of our speakers, has been involved at Stanford--through the computer, is making possible the development of learning experiences to meet the particular needs of individual students. And indications are that computer-mediated instructional techniques like CAI can succeed in permitting students to involve themselves at their own rate in the learning process. Even computer games have been successfully employed at John Hopkins University as a method of teaching teenagers to think through appropriate career choices. Some of the more familiar media developments--instructional television, single-concept films, video tape, the teaching machines, stimulators--are not commonplace now but they will be in the classrooms of the 70's. Textbooks will appear which will gear information to the background and reading level of the student. Experiments with tutorial programs, while these are not exactly instructional media, do offer some hope for giving more intensive attention to those children requiring it, while at the same time helping to offset the spiraling cost of education. Each of these examples, I think, illustrates that we are in the takeoff stage and can, with your help, in both planning and funding, achieve the outreaches of educational excellence.

New opportunities for research on major curricula redesign have resulted from the stimulation of federal legislation, particularly the Vocational Education Act of 1963, and the new Elementary-Secondary Education Act, Title IV. These opportunities are occurring at a time when you are under more pressure to provide each youngster with the kind of education which is relevant to living in today's world. We know that the educator and the employer must work together to determine what are the appropriate knowledge, kinds of skills and types of attitudes that will equip students for their life roles as employed adult citizens. Unless we radically modify our present system, I am convinced, we will not succeed in designing an educational program which will be responsive to the present-day needs of students.

The desired program, I think, should permit the maximum self-actualization of students in such a way that if a youngster leaves school before graduation--before he gets his high school diploma--he will leave with some set of functional skills and will be able to qualify for these entry-level jobs. Assuming he does graduate from the program, he should possess the necessary qualifications for maximum flexability in his post-guidance high school activities. He might enter a university or community college and pursue an academic program; he might enter a community college or a technical school and receive post-high school occupational training. He should also have entry-level occupational skills which permit him to go to work. He should have the additional option of continuing his education in an adult education program if he chooses. The key point is that he should be able to select, from among a number of options available to him, which activity is most appropriate.

I will bring my remarks to a close here and simply pose for you several questions that have been in my mind--questions which you may want to have in your mind as you progress through the week's program. I think these are particularly relevant for the vocational educators. Here they are:

First, are we giving enough attention to using the vocational education system to educate the whole man? Can skill-training without the foundation in general education realistically prepare a person for today's job and the current requirements in community and national life? How can we define vocational as basic education so that those who leave the general academic track get a second change? Conversely, how do we assure those students who travel the vocational route, but who belatedly discover academic interests, that they will not be penalized for any commitment to one area or the other?

Secondly, what programs can we develop to individualize the instructional process and to find ways to break through particular learning programs or problems no matter how unique they may be? What specific steps, in other words, can be taken to motivate and reshape the lives of youngsters whose crippling environment and backgrounds might otherwise make them unqualified for employment opportunities in the future?

Thirdly, what about the family environment of the youngster who finds his way into a vocational school? The ability to learn and the potential that he has to learn is equally influenced by his own environment. Are there ways that we can find to influence that environment and the family unit in such a manner as to enlarge the learning potential of the child? A nearby city is being planned between Baltimore and Washington. They are already talking about closed-circuit link-up with the home; they have established multi-channel connections with homes and the local schools so that self-learning and student programs can be piped into the homes. Stability and emotional security of the home supply some of that experience contributing to the willingness of the child to learn--these provide the essential background elements with which he approaches his school environment.

Fourthly, and the last question I'll pose today, is: What can be done to insure that children acquire the basic reading, writing, communicative, and reasoning skills that they need to perform adequately as adults? What is the best age to begin this type of education? Are we presently waiting too long and thus running unnecessary risk in losing potential learners?

I must say that you are in an enviable position in examining education media. You are in an area of study--educational technology--that will offer us a real chance for modifying and improving vocational education as we know it today.

PART II - EDUCATIONAL MEDIA AND THE INSTRUCTIONAL TASK

LEARNING THEORY, MEDIA OF INSTRUCTION, AND VOCATIONAL EDUCATION

Leslie J. Briggs[1]

One day a man strode into a barber shop and proclaimed loudly, "I can lick any man in this room." Silence. He then said even louder, "I can lick any man in this town." Still silence. Then he yelled, "I can lick any man in this country." Whereupon a customer got out of a chair and knocked the man down. Picking himself up off the floor, the man muttered, "I guess I took in a little too much territory that last time."

I feel much like that man did about the topic which has been assigned to me. It seems to take in a lot of territory. But to look upon the bright side, perhaps this gives me some excuse for a superficial treatment of it. In any case it permits me to choose the ground on which I feel most comfortable and to skirt around some of the many quagmires which exist within the territory.

The three phrases in the title of the topic--learning theory, media of instruction, and vocational education--constitute a rough outline for this paper. I need only to indicate by way of introduction how these three topics relate to each other in my thinking, and also to indicate a fourth topic which represents a framework for relating learning theory and media to the task of planning instruction for vocational curricula.

Before launching into each of the four topics in turn, then, I might just give a synopsis of each. Concerning learning theory, I will say that it is not useful for planning of instruction in any general, across the board manner. I will emphasize that there are many kinds of learning, not just one, and that since each learning theory seems to focus upon one kind of learning or another, no one theory is of completely general usefulness. I will recommend cautious and discriminative use of both the facts and the theories resulting from the scientific study of learning, in order to guard against inappropriate applications to the design of teaching procedures.

---

[1] Dr. Briggs is director of the Instructional Methods Program, American Institutes for Research, Palo Alto, California.

Concerning media of instruction, I will say something similar to what I say about learning theory--namely that no one medium is by nature better or worse than another, just as no one learning theory is by nature any better or worse than another. In each case it is a matter of selecting the specific learning theory or the specific medium of instruction in terms of some particular educational objective.

Concerning vocational education, I will relate type of learning and type of media to type of educational objective, and I will point out that a look backward into media developed for military technical training can be very useful for those aspects of vocational education often thought of as technical education.

Finally, to make the other three elements fit together under some comprehensive framework, I would like to discuss systematic approaches for the design and development of curricula and instructional materials.

In covering these four topics I have found it convenient to use certain analogies which may communicate some points, even at the risk of introducing inaccuracies. For example, in speaking of learning theory, I will refer to blind men and elephants. In speaking of instructional media, I will refer to tool kits, hammers and saws, and the matter of how to choose appropriate tools as distinct from how to use tools or how to sharpen tools. And finally, in speaking of an overall strategy for planning instruction I will distinguish among the proper occasions for using blueprints, scaffolds, and brick and mortar.

LEARNING THEORY

My first thesis is that no existing learning theory can serve as an adequate model or blueprint for all the learning which takes place in a given course of instruction. As Bruner (1963) has shown, current learning theories do not meet the requirements of the needed theory of instruction. This is partly because each theory is limited to some narrow aspect of all learning, and consequently indiscriminate applications of the theory generally lead to poor results. But the facts available for each type of learning, as well as the theory to some extent, can be useful in designing some selected parts of the instruction. Both fact and theory are then to be used at appropriate times as the brick and mortar of instruction, not as the scaffold or blueprint. While current theories have their defects, it is defective application which can turn defect into disaster.

Bruner (1963) has pointed to programmed instruction as a case in point. The current form of programmed instruction most commonly in use was founded upon the theory underlying operant conditioning, one of the eight types of learning identified by Gagne (1965). Were programmers to vary their style of programming to adapt to the different conditions of learning needed for the eight types of learning, much more good would be done--and some of the resulting programs, I venture to say, would resemble more closely Pressey's form of adjunct autoinstruction (1967) than the now current forms.

Learning theory has developed from the associationistic doctrine begun by the early Greek philosophers and continuing through certain later English philosophers. The concept of association has been employed at the philosophical level, the physiological level, and more currently the behavioral level of explanation. The matter of *what* is presumed to be associated, thus runs the gamut from images, ideas, stimuli, responses, entire sequences of experienced phenomena, and neurological processes. *How* the associations are formed is attributed variously to contiguity, to frequent practice, to reinforcement, and to insight. An interesting feature of the history of learning theory in our present context is that as new theories developed, they were probably at first intended by their authors only as explanations for the limited kind of learning each investigator was studying. Thus Thorndike was trying to explain how cats learn to find their way out of puzzle boxes, Watson was trying to expain how complex chains of conditioned responses are formed, McGeoch was trying to explain how pairs of nonsense syllables in a series get memorized, and Kohler and Harlow were trying to explain how apes transfer the value of one learning experience to arriving at a solution to the next problem. Each learning theory somehow later came to be viewed as in competition with other learning theories, and considerable controversy ensued as to which learning theory was right. It was as though the learning theorists themselves, as well as their students, forgot that each theory was attempting to explain a somewhat different class of learning. The situation thus was analogous to the case in which eight different chemists would be analyzing eight different compounds and trying to identify and describe the ingredients. If we were to forget that there were eight different compounds being analyzed instead of one, we would be quite amazed at the variety of reports given, and we might be tempted to conclude that the chemists were not very competent. Considering that each learning theorist *was* sampling a different kind of learning, but this somehow became forgotten, we may easily understand why learning theory has often been spoken of in the same breath with blind men and elephants.

But not all learning theorists ignored the evidence that there are several kinds of learning. Tolman identified six kinds (1949); Woodworth identified five (1958); and Ausubel, six (1963). But in general, students of learning theory have emphasized the plural nature of learning more than the theorists themselves have. Some of the clearest statements of the implications of the several kinds of learning have been made by Gagne (1965), Hilgard (1956), Melton (1962), and Pressey and Kinzer (1964).

While there is some disagreement on the number and naming of the types of learning, Gagne's treatment of the topic is especially lucid in regard to implications for teaching procedures and teaching materials. I cannot attempt to review here the effective teaching conditions for each kind of learning as presented by him. For this I recommend reading of his book entitled The Conditions of Learning (1965). Suffice it to say now that Gagne identifies problem solving, learning of principles, and learning of concepts as three of the most important kinds of learning in education. He also shows that the eight types form a hierarchy of complexity, in which each higher order of learning is based on prior learning of the simpler kinds. Problem solving is the highest and most complex form of learning for which he attempts to prescribe teaching and learning conditions. He believes that further research is needed to identify the conditions contributing to creativity and inquiry learning. As a consequence, we now have available a factual and scientific basis for designing of instruction from problem solving on down, but we must depend mostly on intuition in planning exercises designed to stimulate inventiveness and creativity.

Ausubel (1963) makes a useful distinction between reception learning and discovery learning. By reception learning he means what some mean by didactic instruction, in which the entire content of what is to be learned is presented to the learner in final form. Such reception learning relates to the transmission of information to the learner-receiver. The message transmitted can pertain to rote learning material in which the content arrangement is arbitrary--that is, the learner can't figure out the reason for it--he just accepts it, like a telephone number or a name. Reception learning of meaningful material is reception of non-arbitrary relationships which can be rationalized by or for the student. In opposition to reception learning which is transmitted by lectures, books, and the like, there is discovery learning, in which the entire content is not given directly to the student. Rather, under appropriate guidance, he is led to recall relevant ideas and principles and to use them to derive new ideas for himself. This learning by discovery can involve the discovery of either rote or meaningful relationships, that is, either arbitrary or non-arbitrary relationships. Now this pair of dichotomies--

reception/discovery and rote/meaningful--are general dichotomies under which Ausubel subsumes other specific kinds of learning such as conditioning, motor skills, perceptual learning, and simple discrimination, each of which require different explanatory principles. I have found it possible also to classify the eight kinds of learning Gagne identifies under Ausubel's two general dichotomies. Thus some degree of patterning is discernible among the various authors of texts in learning as to the various kinds of learning.

In summary of learning theory, then, it is not sensible to ask which learning theory is best generally, but rather which theory is relevant for what type of learning. Once this important idea is grasped, one can then examine an instructional objective, then classify it by type of learning which identifies the relevant conditions of learning. Having done this, one matches the medium of instruction with the objective.

MEDIA OF INSTRUCTION

Now let us examine media of instruction in the light of the several kinds of learning. Just as one must pick the right conditions of learning for the kind of learning required for a given educational objective, so one should select the media of instruction. No one medium is good or bad generally. It is a matter of selecting media which possess such characteristics as to make it possible to implement the appropriate conditions of learning. A good carpenter has a tool kit containing many tools, not just one. No one would think of hiring a carpenter by asking whether he is a hammer theorist or a saw theorist. I hope that no one would select a single instructional medium for universal use on the basis that it is a memory medium or a problem-solving medium. It is not sensible to ask whether motion pictures are more useful than textbooks or programmed instruction, without specifying useful for what.

Just as it is foolish to debate whether a saw or a hammer is more effective for building a house, it is completely unnecessary to be for or against any particular medium of instruction. The problem is to do just what the carpenter does, namely select the best tool for the task at hand. If the analogy of the tool kit is of any value, we would then expect multi-media instruction to do a better job for a total vocational curriculum than would any single medium of instruction in our educational tool kit.

But a carpenter is not skilled solely on the basis that he knows how to choose and use the right tool for the right purpose. He is also expected to know something about how to keep his tools in working order. In addition to knowing to choose a saw when a board is to be cut and to use it to cut the board, he is also expected to know how to sharpen the saw.

In the field of instructional materials the media developer needs to have information about how to choose the right medium for the purpose, but he also needs to know about the research which can lead to a sharpening of the tool. For example, much of the research in motion picture films has dealt with the specific techniques in film making which can lead to a sharpening of the use of films for given purposes. Unlike the carpenter, however, the designer of instruction is a maker of tools as well as a selector, user, and sharpener of tools. A motivational film does not have the same characteristics as an advertising film or a teaching film. The script for teaching a series of steps is unlike a script for telling a story. The film maker has to learn to blend different ingredients in different ways to make different varieties of the same tool effective.

The one thing a good carpenter never does is to compare the general effectiveness of a hammer with the general effectiveness of a saw. Unfortunately, some media researchers do just that. It is necessary to avoid asking whether the film or programmed instruction is better for teaching vocational agriculture. It is necessary first to identify a specific objective in the teaching of agriculture, to define the type of learning it represents , to refer to the literature to see what types of conditions are relevant, and then choose or make a tool which provides those conditions, not some other conditions. A book on this procedure is available (Briggs et al., 1967)

VOCATIONAL EDUCATION

Just as World War I was a stimulus to the development and widespread use of mental tests, World War II marks the beginning of the stage of greatest development in audiovisual instruction. Thus during World War II, films were used for motivational and indoctrination purposes and for instructing men on a variety of topics from health to combat maneuvers. At the close of World War II, highly creative uses were developed for all kinds of new media of instruction. Another stimulus was provided by Sputnik. Perhaps the Golden Age in equipment, devices and media of instruction began with World War II and accelerated even more after 1946. During this period, each branch of the armed forces devoted intensive effort to the development of a training technology by which job requirements could be translated into training objectives, which were then established by selection, design and development of a great variety of instructional media and techniques. Great strides were made, for example, in the techniques of training films and mechanical devices for teaching tasks like mechanical assembly and trouble-shooting of electronic equipment. Some rather strange-sounding terms were coined for some of these devices. For example, the "handy dandy" was probably the first prototype of the closed loop film cartridge. Another device called the "subject-matter trainer" was much more flexible than the now-common teaching machine in that it provided the conditions either for rote, paired associate learning, for learning of actions in a sequence, or for analyzing and solving problems. All types of simulators were developed using both audio and visual channels of communication and programmed in such a way as to provide functions now called prompting, branching, and feedback. Job aids were developed which, as distinct from training aids, were of permanent value as cues on the job and enabled training to be simplified and abbreviated.

While the instructional techniques and devices developed in this Golden Age of audiovisual devices in the military tended to emphasize teaching of job activities more similar perhaps to technical training than to clerical training, the considerable overlap between vocational education and military technical training suggests that not all the ideas and devices first developed under military auspices have yet found their way into educational practice. It is suggested that a survey of those devices and techniques in terms of the needs of vocational education could lead to some very stimulating and useful applications. It should be pointed out that those military applications did utilize learning theory and the facts from the study of learning, but more significantly the total developmental effort focused upon the analysis of the job requirements as the place to begin. As a part of this developing military training technology, many advances were made which are now being carried on under such headings as "systems and operations analysis," "task analysis," and "educational technology." In fact it is the overall approach which was employed in developing these military innovations which has the most transferable value to vocational education.

A DILEMMA AND A PARADOX

Vocational education faces the dilemma that young people need to be trained in the specific skills which will enable them to make a living at an existing job in our society. On the other hand, they must be prepared to cope with changing job requirements which for many will mean major changes in their vocational objectives possibly several times during their adult life. Employers thus, on one hand, are demanding that vocational training be more job oriented and include teaching of specific skills as a part of the curriculum; on the other hand, the changing needs of society predicted for the future stress the need for training in discovery, adaptation, and coping with problems now unforeseen. The need to teach skills now in demand may be described as the need to "transmit the present culture." On the other hand, there is the need to prepare the young person to solve problems this generation of adults has either failed to solve or has not yet even faced. This, of course, represents a dilemma in respect to curriculum content. The best available solution I know is to teach specific skills which are widely needed and are thus labeled generalizable skills, while helping the student to also exercise his discovery and problem-solving capabilities. Skills can be taught by didactic methods as a part of transmission of present culture. The other curriculum need apparently cannot be met by conveying content from the culture presently existing, and thus the dilemma of vocational education appears to merge with a paradox which exists both in learning theory and in educational philosophy. Some advocate highly prompted didactic instruction, and some want to see more discovery learning. The dilemma can be reduced somewhat by deciding the issue for each type of learning separately. The conditions for verbal memorization are prompted, didactic conditions. The conditions for problem solving require a less direct form of guidance and more responsibility for selective recall on the part of the learner. The overuse of discovery for the wrong kind of learning is wasteful. There is no need for the student to rediscover everything which he can quickly learn simply by being told. Nor is there a need to repeat all the errors of previous generations. It is better to save discovery effort for learning a few things under conditions of partial guidance as preparation for later problem solving without guidance. Eventually, once an optimum curriculum balance can be struck between transmission of skills and discovery learning, what is known about these two types of learning can then be brought to bear and converted into methods of instruction. It is my present contention that those specific types of learning ranging through Gagne's eight types are now pretty well within our ability to handle, insofar as prescribing effective methods of instruction. But starting with problem solving, the highest of Gagne's eight categories, and going on into inquiry, creativity, and invention behavior, both our facts and our theories are presently inadequate as guides for the design of instruction. At this current point in time then, I believe we have the capability of designing new instructional courses which will more effectively establish the teaching of all of the objectives in the curriculum which are represented from the bottom of Gagne's hierarchy up through the learning of principles. The model I will describe in the closing section of my paper can now be implemented for the range of objectives falling within this range of learning types. It is a difficult undertaking requiring money and systematic effort, but I believe it can now be done.

Thus, on one hand, we have the task of better implementing the learning for the types of objectives we do know how to handle, and on the other hand, we must pursue research and empirical evaluation in methods designed for those less well understood higher objectives.

A SYSTEMATIC MODEL FOR THE DESIGN OF INSTRUCTION

In this closing section I address myself now to that part of the job which I said I think can now be done, namely the design of instruction for all kinds of objectives up through learning of principles and to some degree some inroad into problem solving. Gradually in the past few years a model for the design of instruction has emerged which perhaps is not adequately expressed in any one written source. However, putting together what we have learned from military and industrial research in systems and operations analysis and specific techniques now labeled the technology of education, I think we can proceed with the outline of the model. I will pause now only to name a few of the sources which I think, taken collectively, indicate the origins of the model. Current knowledge in principles of system development has been summarized by Gagne and others (1962). This summary deals generally with the idea of starting with outputs required of systems, including human systems, and analyzing the nature of the needed inputs. A second source is an outline of an approach to curriculum design by Gagne (1966). This document represents both a systematic approach to curriculum building and sequencing of instructional units, and a system for evaluating and improving the instruction. Two important components of this curriculum model in turn are built upon Gagne's analysis of the various types of learning (1965) and his analysis of educational objectives in terms of their component prerequisites (1962). This latter ingredient in turn enables one to deal with the important problem of sequencing the instruction. Another part of the overall model pertains to the selection of appropriate media of instruction. A document addressed to this step in the procedure is the one by Briggs and others (1967). Finally, the whole idea of subjecting the entire procedure to empirical tryout and revision, while not an entirely new idea, is drawn largely from the practitioners of programmed instruction and thus the origin rests with many different practitioners. However, one example of how now-standard empirical procedures can be even further developed is reported by Markle (1967). Putting all of these sources together then, it seems possible to attempt an outline of the major steps in the procedure for designing instructional packages, resulting usually in multiple media, to meet all of those objectives in a curriculum which are not higher on the hierarchy than the category of problem solving. The outline of the procedure which I believe can be adopted for designing the curricula of the future is as follows: 1) convert generally stated curriculum objectives into statements of behavioral objectives; 2) analyze each behavioral objective to derive the subordinate competencies which together make up the total objective; 3) sequence the instructional units in accordance with the nature of the hierarchies resulting from the analyses of the individual objectives; 4) employ information about conditions of learning for each type of learning in order to select an appropriate medium of instruction for each objective or for a subordinate competency, whichever represents a pure instance of a type of learning; 5) develop draft instructional materials in the media selected for each objective or subordinate competency; 6) revise and refine draft materials in accordance with data from empirical tryouts of the draft materials; and 7) evaluate the instructional materials by administration of written or performance tests which are appropriate for measuring the type of behavior described in the behavioral objectives.

A large team effort is required to implement this model. The Office of Education and the U. S. Naval Academy are planning to allocate funds to do this in some selected subject-matter areas, following the specifications prepared by Briggs and Tallmadge (1967). The ultimate objective of the USOE program is a more functional vocational curriculum. I hope many of us can pitch in and help. Then teachers would not be faced with choosing from among inappropriate or poorly prepared media and materials. Rather they could focus on best use of a curriculum designed on the basis of the appropriate conditions for each of the several types of learning. And I hope you are now convinced there are several kinds.

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EDUCATIONAL MEDIA RESEARCH

Interest Group Session

Edward J. Morrison,[1] Chairman
Leslie J. Briggs,[2] Consultant

This group discussed the needs, strategies, methods, and general results of media research rather than the characteristics of particular media.

Dr. Briggs began the discussion by summarizing conclusions reached from his review of more than 2000 reports on media research. He observed that the research effort has suffered from the failure to combine precision in research procedure with the selection of significant problems for study. Thus, those who have worked with significant, real-life problems rarely have used research procedures which permit unambiguous answers to the research questions they posed. Others have simplified the problems so as to gain control of the variables and have given relatively precise answers to artificially simple problems. A major need in media research is the application of more rigorous research procedures to significant research questions.

Dr. Briggs described three kinds of media research identified in his review:

1. Method A vs. method B.

Studies of this type compared one method or medium (e.g. programmed material) with another (e.g. textbook). Almost none of these studies demonstrated significant differences between methods. Two reasons for this lack of demonstrated difference seem important. First, most things to be learned in school lessons as presently prescribed involve more than one kind of learning. Since no one method (set of learning conditions) is appropriate for all kinds of learning, the net difference between two methods applied to a variety of learning tasks tends to be zero, even when each method is superior for one of the kinds of learning tasks included. Secondly, the differences between methods are obscured by such practical difficulties as having only an excellently written program to compare with a poorly prepared film. The difficulties encountered in the method A vs. method B studies illustrate the need for more research precision for investigating real-life problems.

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2. Sharpening the tool.

Many very useful and effective studies have been done to answer specific questions about the use of media. For example, the Navy has sponsored a series of studies designed to find out how to make more effective training films. Programmed instruction as a medium has benefited from many studies designed to determine optimum step size, the effects of branching, the amount and kind of prompting which is effective, etc.

3. Medium itself is a tangential issue.

All learning research requires that some medium be used. Many studies designed to test points concerning the effective conditions for learning also, incidentally, provide some information about the use and effectiveness of media.

Through discussion of Dr. Brigg's summary, points of particular interest to participants were explored in more detail. Three of the numerous research questions considered by the group seemed particularly important.

1. Can the new media help with such problems as larger class sizes or do they contribute only to improved quality of instruction?

It was concluded that the new media offer many advantages other than improved learning if they are imaginatively and appropriately applied. Dr. Briggs pointed out that a major value is the increased possibility for satisfying the different learning needs of individual students. As an example, the ability of some programmed instructional material to branch depending on the student's needs and interests was seen as providing unusual flexibility which is a valuable aid to effective learning, to appropriate and individualized curriculum enrichment, and to improvisation of needed learning sequences by the teacher. Many possible uses of newer media remain to be explored and evaluated.

2. How can media be selected to establish effective learning conditions?

At present, principles are not available to provide detailed guidance. Media are not uniquely indicated by the type of learning to be accomplished or by the subject matter involved. References were cited in which some examples of media selection are available. However, it was believed that a manual might be developed which provided a detailed specification and sequence for the judgments and decisions which must be made in selecting media and developing materials.

3. How can media be described so that their appropriate applications in learning situations are indicated?

This was recognized to be a fundamental problem for research and theory. The prescription of media for particular applications requires description of the media in terms of significant variables defining learning conditions. This taxonomy remains to be developed.

EDUCATIONAL OBJECTIVES—FOUR DOMAINS

Elizabeth Simpson[1]

The three taxonomies of educational objectives--one in the cognitive domain, a second in the affective domain, and a third in the psychomotor domain--represent efforts to analyze educational objectives found in the school program. Professor Ray Loree (1966), speaking to Home Economics educators at the AVA Convention in December, said that, "One danger in fragmenting the educational venture into specific educational objectives is that important global objectives may be lost in the process." He was referring to such objectives as, "Ability to manage a home," "Ability to teach kindergarten," and the like. These broad objectives clearly incorporate many sub-objectives. They are beyond; they encompass objectives in all three domains. Hence, they might be considered in a fourth major area of objectives--a fourth domain, perhaps? Or does the term, domain, fit here? I am not sure.

The fourth domain, if you will, might be labeled the "action pattern domain." I suppose that I am being presumptuous in borrowing the term from Loree, who defined this domain somewhat differently. He saw it as the third domain and the psychomotor skills as constituting one category within this domain (Loree, 1965). I agree with the concept of psychomotor abilities and skills as an area within the action pattern domain, but it seems to me that they are important enough in the total teaching-learning situation to identify as a separate and major domain of educational objectives.

Hence, we arrive at four domains of educational objectives: cognitive, affective, psychomotor, and--beyond and encompassing the other three--the action pattern domain.

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COGNITIVE DOMAIN

The Taxonomy of Educational Objectives, Cognitive Domain (Bloom et al., 1956), provided for classification of educational goals which deal with the recall or recognition of knowledge and the development of intellectual abilities and skills. Briefly, the purposes of the taxonomy as given by its originators are the following:

1. To help teachers, administrators, professional specialists and research workers who deal with curricular and evaluation problems to discuss their problems with greater precision;
2. To facilitate the exchange of information about curricular developments and evaluation devices;
3. To suggest the kinds of objectives that can be included in a curriculum;
4. To help teachers and others to gain a perspective on the emphasis given to certain behaviors by a particular set of educational plans;
5. To help curriculum builders to specify objectives so that it becomes easier to plan learning experiences and prepare evaluation devices.

Experience in using the taxonomies of educational objectives reveals uses that were perhaps unanticipated by the originators. The systems are useful in analyzing and planning with respect to all of the major aspects of curriculum development: Objectives, learning experiences, content, teaching aids and facilities, and means of evaluation. The purposes of the taxonomy as set forth in the handbook on the cognitive domain are applicable to the classification systems for all of the domains.

Categories in the Cognitive Domain

Educational objectives in the cognitive domain have been classified into six categories. These are: knowledge; comprehension; application; analysis; synthesis; and evaluation. These major categories are ordered on the basis of complexity, with knowledge being the least complex category and evaluation the most complex. Subsumed in each succeeding category are the behaviors described in the preceding categories.

Let us look at each level in the cognitive domain, consider the behaviors that are involved within that level and identify some examples of educational objectives for each.

1. Knowledge - Here we are concerned with the ability to recall, to bring to mind the appropriate material. Sub-categories are concerned with the knowledge of specifics, ways and means of dealing with specifics, and the universals and abstractions in a field. Examples of educational objectives are:

   "To know the terminology of decision-making." This is an objective in home management. The instructor considers that knowledge of such terms as problem-solving approach, conflict, dissonance, and alternatives within the context of the home management situation is basic to the other purposes of the course.

   "Knows the social roles of adolescent girls." This is an objective for a seventh-grade home economics class. The teacher classified this as "knowledge of specific facts."

   "Knows the five classes of nutrients and the function of each major nutrient." This objective for a ninth-grade class may be classified as knowledge of classifications and categories."

2. Comprehension-- The comprehension level is concerned with ability to apprehend what is being communicated and make use of the idea without necessarily relating it to other ideas or material or seeing fullest meaning. Knowledge is basic to comprehension.

   There are three sub-categories within this level: translation, interpretation, and extrapolation. In the translation type of comprehension, the individual puts a communication into another language, for example, Spanish into English, mathematical symbols into verbal language, musical notes into sounds, markings on a pattern into verbal language.

   Interpretation involves seeing the various parts of a communication, and understanding them well enough to permit a reordering, rearrangement, or a new view of the material. An example of an educational objective at this level is: "Understands that each girl develops at her own growth rate."

   Extrapolation is concerned with "the extension of trends or tendencies beyond the given data to determine implications, consequences, corollaries, effects, etc." (Bloom, 1956) The objective, "To predict consequences of varying methods and degrees of resource utilization," fits this level. The student who achieves this objective can, at least to some extent, predict possible effects of current resource utilization on future resources; of family resource usage on national economy; of national resource usage on world peace.

3. Application - Achievement of objectives in the knowledge and comprehension categories enables one to move ahead to the level of application. Here we are concerned about ability to use ideas, principles, and theories, in particular and concrete situations. Examples of educational objectives in this category are easy to come by; curriculum guides abound with them.

   An example from a college course in home management is: "The ability to apply problem-solving methods to given situations in home management." Another example: "Ability to apply principles of protein cookery in preparing meat."

4. Analysis - Objectives at this level involve breaking down a communication into its elements or parts, of seeing the relationships among the parts and the ways in which they are organized. Analysis requires application, comprehension, and knowledge. There are three sub-categories of this level: analysis of elements, analysis of relationships, and analysis of organizational principles.

   Examples of educational objectives include:
   Analysis of elements - "Analysis of the elements of decision-making."
   Analysis of relationships - "To analyze the interrelationships of elements of decision-making."
   Analysis of organizational principles - "Ability to see the techniques used in persuasive materials, such as advertising, propaganda, etc." "Ability to recognize the point of view or bias of those currently writing about the changing roles of women."

5. Synthesis - Loree (1966) stated that, "Synthesis is the opposite process (that is, opposite to analysis). Synthesis objectives involve putting

together elements so as to form a unique whole. This is the category that gives widest scope to creative behavior on the part of the learner." Sub-categories include: Production of a unique communication, production of a plan or proposed set of operations, and derivation of a set of abstract relations.

Suppose we examine some educational objectives that fit into each of these sub-categories:
Production of a unique communication - "Ability to write creatively a story, essay, or verse for personal pleasure, or for the entertainment or information of others."
Production of a plan or proposed set of operations - "Ability to develop a plan for a teching unit."
Derivation of a set of abstract relations - This is another example from Miss Kinsey Green's plan for a university course in home management: "To formulate hypotheses regarding resource creation and utilization."

6. Evaluation - This is the most complex category in the cognitive domain. It involves ability to judge the value of ideas, procedures, methods, etc., using appropriate criteria. The two sub-categories are: judgments in terms of internal evidence and judgments in terms of external criteria.

Judgments in terms of internal evidence are concerned with the evaluation of the accuracy of a communication from such evidence as logical accuracy, consistency, and other internal criteria. A related educational objective might be: "Judging by internal standards, the ability to assess general probability of accuracy in reporting facts from the care given to exactness of statement, documentation, proof, etc."

"To evaluate work simplification techniques" is an example of an educational objective which involves judgments in terms of external criteria.

It would seem apparent that the category of evaluation requires knowledge, comprehension, application, analysis and synthesis.

AFFECTIVE DOMAIN

Now, let us turn our attention to the affective domain. It is impossible to conceive of any educational program where objectives in this domain are not of some concern. It seems to me that every objective in the cognitive domain probably has a corollary in the affective domain. Objectives in this domain have to do with interests, desires, attitudes, and valuations.

The committee working on the affective domain searched for some time for an organizing principle that would be comparable to the principle of complexity used in determining the hierarchy in the cognitive domain. The principle that finally emerged was that of internalization. As explained by Loree (1965):

> It seems that some educational objectives primarily define a student's response to some external situation. The desired behavior expressed in the objective depends upon the appearance of some specific external situation. The environment acts upon the learner. At the other end of the continuum some educational objectives in the affective domain appear to describe an expression of the learner's innermost self. The learner acts upon the environment. The behavior depends not so much on the external situation as upon certain deep-seated characteristics of the learner.

Five major categories were defined in the affective domain taxonomy. These are: 1) receiving or attending; 2) responding; 3) valuing; 4) organization; and 5) characterization by a value or value complex.

In developing a better understanding of the classification system suggested for this domain, I found it helpful to take a value of my own and trace its development in my life from the point of awareness through increasing interest, response, commitment, and finally the conceptualization of the value, and its place among other important values. Recently, I went through these steps with a summer school class in evaluation. They and I agree that I haven't yet reached the highest level of characterization in the affective domain with respect to this value. The value was that of poetry--not just as words on a page but as a means of self-expression and a way of looking at life. This exercise of using the affective domain taxonomy in looking at your own internalization as a value might prove of some interest; anyway, it is fun to do!

Suppose we examine the categories in this domain and look at some educational objectives that fit each level.

1. Receiving (Attending)--"At this level we are concerned that the learner be sensitized to the

existence of certain phenomena and stimuli; that is, that he be willing to receive and to attend to them." (Krathwohl *et al.*, 1964).

This level has three sub-categories: awareness, willingness to receive, and controlled or selected attention. Some objectives in this category are:

"Develops awareness of rhythm in poetry" - first level, awareness;

"Increased sensitivity to poetry in various in-class and out-of-class situations" - willingness to receive;

"Reads or listens to poetry with some discrimination as to form, rhythm, mood, and meaning or purpose"--controlled or selected attention;

The first level of receiving is requisite to the next level, that of responding.

2. Responding - At this level, we are concerned with responses that go beyond merely attending to a phenomenon. Three sub-categories are included under responding.

The first is "acquiescence in responding." An example of an educational objective that would be classified at this level is "Follows the general guidelines for conduct in the quantity foods laboratory." Compliance describes this behavior. The student makes the response, but has not fully accepted the necessity for doing so.

The second sub-category is "willingness to respond." There is an implication of capacity for voluntary activity. The learner is sufficiently committed to proceed from his own choice. An example of an objective at this level: "Acquaints himself with a variety of poetic forms and poets through voluntary reading and discussion."

The third sub-category, "satisfaction in response," has an added element, that of a feeling of satisfaction, pleasure, zest, or enjoyment in response. For example, "Finds pleasure in reading and discussing poetry and expressing self in attempts at creating poetry."

3. Valuing - Krathwohl et al., (1964) states that:

> (The term, valuing)..."is employed in its usual sense: That a thing, phenomenon, or behavior has worth. This abstract concept of worth is in part a result of the individual's own valuing or assessment, but it is much more a social product that has been slowly internalized or accepted and has come to be used by the student as his own criterion of worth."

This level requires attending and responding. Three sub-categories have been identified. The first is acceptance of a value. An objective here might be "Continuing desire to develop the ability to write poetry."

The second, preference for a value, is concerned with behavior that implies not just the acceptance of a value to the point of being willing to be identified with it, but that the individual is sufficiently committed to the value to pursue it, to seek it out, to want it. An example of an educational objective: "Actively participates in arranging for the showing of contemporary artistic efforts."

The third sub-category, commitment, involves a high degree of certainty. "The person who displays behavior at this level is clearly perceived as holding the value. He acts to further the thing valued in some way, to extend the possibility of his developing it, to deepen his involvement with it and with the things representing it." (Krathwohl et al., 1964) An example of an educational objective that involves the concept of commitment is "Devotion to those ideas and ideals which are the foundations of democracy."

4. Organization - "As the learner...internalizes values, he encounters situations where more than one value is relevant. In this category, the learner organizes his values into a system, determines the interrelationships among his values and establishes the dominant and pervasive values. For example, the (person) who has learned to value both honesty and sensitivity to the feelings of others may encounter situations where these values conflict." (Krathwohl, et al., 1964) He determines, for given situations, which will predominate.

There are two sub-categories at this level. They are conceptualization of a value and organization of a value system. At the level of conceptualization of a value, the quality of abstraction or conceptualization is added to valuing. Krathwohl has noted that, "Whether conceptualization first appears at this point on the affective continuum is (really) a moot point." With respect to some objectives, it undoubtedly appears earlier. An educational objective that fits this level is: "Forms judgements as to the responsibility of society for conserving human and material resources."

Objectives properly classified as relating to organization of a value system are those which require the learner to bring together a complex of values and to bring these into an ordered relationship with one another. For example, the objectives: "Weighs alternative social policies and practices against the standards of the public welfare rather than the advantage of specialized and narrow interest groups."

5. Characterization by a value or value complex-- "Maximum internalization characterizes objectives in this final category. The behaviors exemplified by attainment of an objective in this...category are expressions of a person's unique personality characteristics and his philosophy of life." (Loree, 1966) Two levels have been identified, generalized set and characterization. "A generalized set is a basic orientation which enables the individual to reduce and order the complex world about him and to act consistently and effectively in it." (Krathwohl, 1964) A related educational objective from the handbook on the affective domain: "Readiness to revise judgments and to change behavior in the light of evidence."

6. Characterization--represents the peak of the internalization process. Those objectives which are found here are those concerned with one's view of the universe, one's philosophy of life. "These objectives are so encompassing that they tend to characterize the individual almost completely." (Krathwohl, 1964) For example, "Develops a consistent view of personal and professional life based on the central value of responsibility toward self and others."

> There are many questions that one might wish to explore with respect to the taxonomy for this domain. It is provocative of discussion concerning the teacher's responsibility with respect to teaching values, means of evaluating progress toward objectives in this domain (not easy) and, of course, the philosophical bases upon which this classification system rests. Time does not permit pursuing these fascinating questions. In leaving our discussion of this domain for the moment, I might add that I have found students this summer making rather extensive use of Raths' book, Values and Teaching (1966) in planning means of evaluating student progress toward objectives in the affective domain.

PSYCHOMOTOR DOMAIN

Many who made use of the two taxonomies of educational objectives, cognitive and affective domains, felt a serious lack in not having a classification system for educational objectives in the psychomotor domain for use in the development of curriculum materials and as a basis for evaluation of educational outcomes. The psychomotor domain has relevance for education in general as well as for such areas of specialization as industrial education, agriculture, home economics, music, art, and physical education.

One of the investigations that my co-workers and I carried out over a two-year period has emerged a classification system for educational objectives in the psychomotor domain. Whereas I do not believe that this system is "on the wrong track," I believe that it is in need of further development and of trial in a variety of test situations. I present the system to you for your consideration, hoping that you may be willing to try it and let me know the results. Also, I hope that you will feel free to react quite critically to what has been achieved to date. Working in this area was an unbelievable quantity of fun and it provided a marvelous opportunity for learning some important things about educational objectives and motor learning.

Preliminary investigations with respect to the development of the classification system for educational objectives in the psychomotor domain led to the conclusion that there is a hierarchy among the three domains. The cognitive domain, though certainly very complex, is, in a sense, somewhat "purer" than the other two domains. That is, cognition can take place with a minimum of motor activity. Also, feeling may not be greatly involved--although it would seem reasonable to assume some degree of affect. The affective domain necessarily involves considerable cognition as well as feeling. And, the psychomotor domain, as implied in the very name, involves cognition and motor activity, as well as affective components involved in the willingness to act. The increasingly strong involvement of all three domains, from the cognitive to the affective to the psychomotor, resulted in a special problem of complexity in developing a classification system for this third domain.

A number of references were located which threw some light on the problem of developing a classification system for educational objectives in the psychomotor domain. Two assistants who worked on the project, Nancy Carlson and Mildred Griggs, published an annotated bibliography on the psychomotor domain. (1966) This is available for fifty cents from the Division of Home Economics Education, University of Illinois, Urbana. A review of literature dealing with material relevant to the domain is contained in a report of the project which appears in the Illinois Teacher of Home Economics, (Simpson).

The approach taken in developing the classification system for the psychomotor domain was an exploratory one. General procedures to guide the investigators were outlined, but these were deliberately left flexible, accommodative, and "open."

The disadvantage of such an approach is the possibility of some loss of time and energy in pursuing the objective; that is, this approach may be somewhat lacking in efficiency. On the other hand, it avoids the narrow restrictiveness of a more cut-and-dried approach. It opens the way for the possibilities of greater creativeness.

General procedures included the following:

1. A comprehensive review of related literature, especially of any that described ways of classifying psychomotor activities, and, hence, suggested possibilities for classifying the educational objectives of this domain.

2. Collecting and analyzing the behavioral objectives of this domain as one way of gaining insight regarding a possible classification system.

3. Laboratory analyses of certain tasks to discover by observation and introspection the nature of the psychomotor activity involved. These analyses were carried our by the research assistants on the project who had read widely in the area before attempting the analyses.

4. Conferences with scholars who have specialized

knowledge of the nature of psychomotor activity, development of classification systems for educational objectives, and of the areas of study where educational objectives in the psychomotor domain are of paramount concern.

From the beginning, it was readily apparent that, if the classification system were to be taxonomic in form, an "organizing principle" would have to be found. This question was kept in mind as work progressed.

Ascertaining what objectives "fit" in this domain was an early concern. The definition given in the Taxonomy of Educational objectives, Affective Domain (Krathwohl, 1964) served as a guide: Psychomotor objectives are those which "emphasize some muscular or motor skill, some manipulation of material and objects, or some act which requires a neuromuscular coordination."

It was not always an easy task to ascertain whether a given objective was primarily of one type or another. One problem was related to type of performance called for in the objective. The concern of this project is performance of a particular sort, that involving motor activity. But, performance may be almost wholly of a cognitive type and, although at this point of time with reference to the project, it seems a bit strange, confusion sometimes resulted from uncertainty regarding the primary nature of the activity involved in an objective.

Another problem, one that is frequently encountered in analyzing educational objectives in all three domains, had to do with the lack of specificity of the objectives. That is, many that certainly involved a great deal of motor activity, almost equally also involved the other domains. These were broad objectives, such as: Ability to give a successful party. Ability to conduct a meeting. Ability to conduct a play period for small children. The investigators finally concluded that those were in the "action-pattern" domain, hence beyond and encompassing the other three domains.

The Classification System, Psychomotor Domain

With the foregoing brief introduction to the psychomotor domain, I would like to present the schema in its present form. The major organizational principle operative is that of complexity, with attention to the sequence involved in the performance of a motor act.

1.0 Perception--This is an essential first step in performing a motor act. It is the process of becoming aware of objects, qualities, or relations by way of the sense organs. It is the central portion of the situation--interpretation--action chain leading to purposeful motor activity.

The category of perception has been divided into three sub-categories indicating three different levels with respect to the perception process. It seems to the investigator that this level is a parallel of the first category, receiving or attending, in the effective domain.

1.1 Sensory stimulation--Impingement of a stimulus(i) upon one or more of the sense organs.

1.11 *Auditory*--Hearing or the sense or organs of hearing.

1.12 *Visual*--Concerned with the mental pictures or images obtained through the eyes.

1.13 *Tactile*--Pertaining to the sense of touch.

1.14 *Taste*--Ascertain the relish or flavor of by taking a portion into the mouth.

1.15 *Smell*--To perceive by excitation of the olfactory nerves.

1.16 *Kinesthetic*--The muscle sense; pertaining to sensitivity from activation of receptors in muscles, tendons, and joints.

The preceding categories are not presented in any special order of importance, although, in Western cultures, the visual cues are said to have dominance, whereas in some cultures, the auditory and tactile cues may pre-empt the high position we give the visual. Probably no sensible ordering of these is possible at this time. It should also be pointed out that "the cues that guide action may change for a particular motor activity as learning progresses (e.g., kinesthetic cues replacing visual cues)." (Loree, June 1965)

1.1 *Sensory stimulation*--Illustrative educational objectives.

"Sensitivity to auditory cues in playing a musical instrument as a member of a group."

"Awareness of difference in 'hand' of various fabrics."

"Sensitivity to flavors in seasoning food."

1.2 Cue selection--Deciding to what cues one must respond in order to satisfy the particular requirements of task performance.

This involves identification of the cue or cues and associating them with the task to be performed. It may involve grouping of cues in terms of past experience and knowledge. Cues relevant to the situation are selected as a guide to action; irrelevant cues are ignored or discarded.

1.21 Illustrative educational objectives.

"Recognition of operating difficulties with machinery through the sound of the machine in operation."

"Sensing where the needle should be set in beginning machine stitching."

"Recognizing factors to take into account in batting in a softball game."

1.3 Translation--Relating of perception to action in performing a motor act. This is the mental process of determining the meaning of the received for action. It involves symbolic translation, that is, having an image or being reminded of something, "having an idea," as a result of cues received. It may involve insight which is essential in solving a problem through perceiving the relationships essential to solution. Sensory translation is an aspect of this level. It involves "feedback," that is, knowledge of the effects of the process; translation is a continuous part of the motor act being performed.

1.31 *Translation*--Illustrative educational objectives.

"Ability to relate music to dance form."

"Ability to follow a recipe in preparing food."

"Knowledge of the 'feel' of operating a sewing machine successfully and use of this knowledge as a guide in stitching."

2.0 Set--Set is a preparatory adjustment or readiness for a particular kind of action or experience.

Three aspects of set have been identified: mental; physical; and emotional.

2.1 Mental set--Readiness, in the mental sense, to perform a certain motor act. This involves, as prerequisite, the level of perception and its sub-categories which have already been identified. Discrimination, that is, using judgment in making distinctions, is an aspect.

2.11 *Mental set*--Illustrative educational objectives.

"Knowledge of steps in setting the table."

"Knowledge of tools appropriate to performance of various sewing operations."

2.2 Physical set--Readiness in the sense of having made the anatomical adjustments necessary for a motor act to be performed. Readiness, in the physical sense, involves receptor set, that is, sensory attending, or focusing the attention of the needed sensory organs and postural set, or positioning of the body.

2.21 *Physical set*--Illustrative educational objectives.

"Achievement of bodily stance preparatory to bowling."

"Positioning of hands preparatory to typing."

2.3 Emotional set--Readiness in terms of attitudes favorable to the motor act's taking place. Willingness to respond is implied.

2.31 *Emotional set*--Illustrative educational objectives.

"Disposition to perform sewing machine operation to best of ability."

"Desire to operate a production drill press with skill."

3.0 Guided response--This is an early step in the development of skill. Emphasis here is upon the abilities which are components of the more complex skill. Guided response is the overt behavioral act of an individual under the guidance of the instructor. Prerequisite to performance of the act are readiness to respond, in terms of set to produce the overt behavioral act and selection of the appropriate response. Selection of response may be defined as deciding what response must be made in order to satisfy the particular requirements of task performance. There appear to be two major sub-categories, imitation and trial and error.

3.1 Imitation--Imitation is the execution of an act as a direct response to the perception of another person performing the act.

3.11 *Imitation*--Illustrative educational objectives.

"Imitation of the process of stay-stitching the curved neck edge of a bodice."

"Performing a dance step as domonstrated."

"Debeaking a chick in the manner demonstrated."

3.2 Trial and error--Trying various responses, usually with some rationale for each response, until an appropriate response is achieved. The appropriate response is one which meets the requirements of task performance, that is, "gets the job done" or does it more efficiently. This level may be defined as multiple-response learning in which the proper response is selected out of varied behavior, possible through the influence of reward and punishment.

3.21 *Trial and error*--Illustrative educational objectives.

"Discovering the most efficient methods of ironing a blouse through trial of various procedures."

"Ascertaining the sequence for cleaning a room through trial of several patterns."

4.0 Mechanism--Learned response has become habitual. At this level, the learner has achieved a certain confidence and degree of skill in the performance of the act. The act is a part of his repertoire of possible responses to stimuli and the demands of situations where the response is an appropriate one. The response may be more complex than at the preceding level; it may involve some patterning of response in carrying out the task. That is, abilities are combined in action of a skill nature.

4.1 *Mechanism*--Illustrative educational objective.

"Ability to perform a hand-hemming operation."

"Ability to mix ingredients for a butter cake."

"Ability to pollinate an oat flower."

5.0 Complex overt response--At this level, the individual can perform a motor act that is considered complex because of the movement pattern required. At this level, a high degree of skill has been attained. The act can be carried out smoothly and efficiently, that is, with minimum expenditure of time and energy. There are two sub-categories: resolution of uncertainty and automatic performance.

5.1 *Resolution of uncertainty*--The act is performed *without hesitation of the* individual to get a mental picture of task sequence. That is, he knows the sequence required and so proceeds with confidence. The act is here defined as complex in nature.

5.11 *Resolution of uncertainty*--Illustrative educational objectives.

"Skill in operating a milling machine."

"Skill in setting up and operating a production band saw."

"Skill in laying a pattern on fabric and cutting out a garment."

5.2 *Automatic Performance*--At this level, the *individual can perform* a finely coordinated motor skill with a great deal of ease and muscle control.

5.21 *Automatic performance*--Illustrative educational objectives.

"Skill in performing basic steps of national folk dances."

"Skill in tailoring a suit."

"Skill in performing on the violin."

We believe that the schema in its present form is useful. Whether there is sufficient distinction between one category and another may still be a question. Perhaps additional sub-categories to increase the discrimination quality are needed for some of the major sections.

Another question that needs further investigation is: Is there perhaps a sixth major category which might be designated as adapting and originating? Probably such a level is needed. At this level, the individual might be so skilled that he can adapt the action in terms of the specific requirements of individual performer and the situation. He might originate new patterns of action in solving a specific problem. Or, do these activities take place at all levels? Must the individual have attained a high degree of skill in order to adapt and originate?

One next major step is that of providing for trial of the schema in many situations and revising it in light of the trials. Another important step that should be taken is that of looking critically at the relationships among the three domains. It is readily apparent that they are closely related and that a single educational objective might have a particular significance in one domain and another in another domain. For example, at the mental set level in performing a motor act, knowledge is required; hence, an objective that "fits" this level would also fit into the cognitive domain and could be classified here.

Much work is needed in studying the psychomotor domain and its relationships to the other two. Serious consideration needs to be given the "action-pattern" domain suggested by Loree. The roles of subobjectives and the inter-play of "domains" in such broad objectives as the following is a matter requiring investigation: 1) To develop the ability to manage a farm; 2) To express ideas in a clear manner before a group; and 3) To manage a home.

The magnitude of the tasks ahead is readily apparent. Direction is somewhat obscure. But, that is part of the fascination of working on a task that is essentially a creative one.

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IMPLICATIONS FOR MEDIA UTILIZATION

A Reaction Panel

Moderator: Dr. I. Keith Tyler, Professor of Education,
The Ohio State University.

Dr. George Brandon, Head, Department of Vocational Education,
The Pennsylvania State University.
University.

Dr. Elizabeth Simpson, Professor & Director, Division of
Vocational & Technical Education,
University of Illinois.

Dr. Arthur Jensen, Director, Vocational Educational Media
Center, Clemson University.

Dr. Donald J. Tate, Professor and Chairman, Department of
Office Administration and Business
Education, Arizona State University.

Mr. J. C. Levendowski, Teacher Educator in Distributive
Education, The University of Idaho.

Dr. Tyler: We have assembled our panel members in terms of their coverage of the various fields in vocational education, and we are going to ask them to illustrate for you some examples of the use of media to achieve instructional objectives in some of these domains of educational objectives. I would like to start with the domain I think is most difficult to deal with and see if somebody will suggest something immediately. How would you use media--that is, what applications would you suggest--to achieve objectives in the affective domain? This relates to sensitivities, appreciations, attitudes--all these things involving our emotions. I am not using Krathwohl's detailed breakdown, but I am talking about the kinds of things with which we are concerned in the affective domain. Where can we use either media or materials in vocational education to achieve such objectives?

Dr. Jensen: In the field of agriculture--that has been my area of interest--I wonder if we do not have opportunities to use some of the media. For example, in a number of cases we are attempting to go into the agricultural occupations experiences in many vocations. Many times we have difficulty developing with students some of the appreciations for job positions of persons who are in the fields of agricultural mechanics, or sales and services, etc. Perhaps we could use the video-recording procedures we witnessed this morning, make some short video tapes in the field, bring these back into our classroom situations, and use them to develop some of these appreciations for working conditions, for values, and the like, on the part of the employees in a particular field.

Dr. Tyler: Anyone else in another field?

Mr. Levendowski: I think we have an opportunity in distributive education for using video tapes to provide various types of simulated occupational experiences and to give students an opportunity to share in opinions expressed by different people. At the present time, many students do not have this opportunity. In other words, we now have the opportunity to bring the business community into the classroom.

Dr. Tyler: I will speak for Home Economics. At The Ohio State University, instructional television is being used in the field of clothing, not to teach a complete course, but to deal with certain aspects of the course that involve the esthetics of dress, fashions, and the like. This material is brought into the classroom by instructional television because it will develop an appreciation and an interest in modern design, the better use of fabrics, color, etc. I use this as an illustration of the selective use of a medium. I hope this explanation will suggest something to somebody else.

Dr. Simpson: This is something we have been thinking about trying but have not as yet. We felt that it would be worthwhile to make some video tapes in our local businesses and restaurants, etc., so that students in a beginning education course could not only gain a knowledge of what workers do in Home Economics-related occupations but also sense the feel of the work through observing the tapes.

Dr. Brandon: One anecdote occurred to me. In our area--school development--particularly in trade and technical education, I think we are facing up to extensive use of the video tape, at least on an experimental basis. We are, perhaps, thinking of this use at present as an economy device with which we may work on this affective domain in order to eliminate the expense of very time-consuming field trips. We are aware of this possibility, and in the walls of newly-constructed buildings in my state, we are providing channels for a multiplicity of media to be employed.

The problem at the moment is cost--not only the cost of original installation but the cost of annual operation.

Dr. Tyler: If any of you panel members want to go beyond the affective domain, it is quite alright. If you will name the domain and then suggest some practices you have seen, I think this would be helpful.

Dr. Tate: I would like to call to our attention the fact that for many years there have been movies--short movies, film strips, and slides--showing office employees at work. Many of these films are out of date because the workers' clothing is dated, but we have had examples of these affective objectives with us for a long time. Perhaps we could use the newer media to get instant playbacks to keep our material up to date.

Mr. Levendowski: Going back to the cognitive domain, in the area of distributive education, I think we are utilizing more programmed instruction for the first level--that is the acquisition of basic knowledge. This provides us with an opportunity to do individualized instruction and conserve some of our teaching time in the classroom.

Dr. Tyler: While you are thinking, I am reminded that we have two instruments--at least--that are very good for step-by-step instruction in skills. This falls in the psycho-motor domain, I assume. The use of video tapes which are mounted over a bench where workers may be assigned to acquire skills allows the students to see step-by-step the operation to be performed and followed in turn. This is used for courses in fields like dentistry and others in which there are laboratory problems. The point, of course, is that instead of one professor repeating a demonstration to a small group of students time and time again, it is put on video tape and the whole group in the laboratory setting performs this operation a step at a time with the video tape. This is also done with single-concept films or can be done diagramatically on a film strip with accompanying sound. There are a number of devices for this step-by-step instruction in skills that save a great deal of instructor-time.

Dr. Simpson: That would be at the imitation level.

Dr. Tyler: Yes.

Dr. Simpson: Dr. Krathwohl suggested that this same type thing could be done with a person observing himself but that our schema does not provide for this correctly at the present time. However, it seems that this would have good possibilities.

Dr. Tate: I would like to say some more about programmed instruction. There is a young man in the audience who is doing a dissertation on programmed instruction in business communications. I understand there was a dissertation recently completed at the University of Wisconsin that programs, so to speak, the theory of Gregg shorthand. I think there is a great deal going on and I am sure it is occurring in every field. More is being done than we realize. For example, two master's graduate assistants in my department this winter produced, on their own, some of the most creative teaching I have seen in a long time. These two young ladies developed film strips for teaching elementary typewriting. Sometimes I think that we look to the big and the grandiose instead of getting back to some of the basics of media that people can do themselves and do very effectively because they inject their own enthusiasms into it.

Dr. Tyler: Dr. Brandon, you have been working with computer-assisted instruction at Penn State. I am fascinated by the idea that you receive instruction from a machine and it talks back to you. Would you tell us for what level of objectives you can use the computer, or is it confined principally to simple skills and information?

Dr. Brandon: Yes, I will be happy to do this. At the moment we are putting all of our eggs in the basket of the cognitive domain. It is largely a curricular information type of giving and asking. This is worrying our research phychologist who would like to incorporate such factors as interest and motivation. Whether it is a problem of inadequate time at the moment or limitations of the equipment, I do not know. For instance, we have barely started exploring the potential of the computer as an evaluater--namely what it can do about testing and measuring. When you stop to consider this, the horizons are tremendous. We have had no breakthroughs on this whatsoever--not even an ignoble start. We do recognize--and I think every one of you will recognize this problem--that as a student faces a new machine or a new piece of equipment, there is a problem of orientation. The typewriter terminal and the computer are no different. Early in our program the psychologists were aware of this and told us we should allow one hour for student orientation to the typewriter terminal. At that time, our computers were not interlocked with slide projectors or random-access tape recorders. Now our computer configuration has the typewriter terminal, interlocked tape recorders and slide projectors. Both of the latter come on from a signal by the computer. The slide projections produce still pictures, of course, You may stretch your imagination as to what to use in connection with this configuration, realizing that at Penn State we have not used the cathode-ray tube which completely eliminates the typewriter terminal and which may have some other answers for us--at least in my specialization of T & I--that do not force us to rely upon abstract symbols, words, reading, etc.

Dr. Tyler: Do any of you want to add examples of the use of varied media? We had the overhead projector used for presentations to this large group. What about the use of the overhead projector in achieving objectives in any of these domains? Does it have usefulness in vocational education?

Dr. Tate: I know a great many business education people are using the overhead projector with typewriting, shorthand, and secretarial courses. They sometimes use it with their multi-channel laboratories--listening stations, as we call them. I think overhead projectors are being used more effectively all the time, both alone and in conjunction with other media.

Dr. Jensen: Certainly the overhead projector has many potentials. Tomorrow morning we will see some of the ways in which South Carolina is trying to provide overhead transparencies for its teachers. It would seem to me that in any vocational educational task where you can use diagramatic sketches or illustrative material, you can adapt the overhead projector to it.

Dr. Tyler: By the way, this discussion is not confined to the panel, and we would be very happy if some of you would share your experiences in using varied media for achieving this whole range of objectives. Yes. Who are you please?

Dr. Kreutz: I am Shirley Kreutz, University of Nebraska. Asahel Woodruff in Concepts of Teaching has addressed himself principally to teaching the cognitive domain. He has stated that as one works with knowledge (cognitive), or as a learner works with knowledge conceptually, he comes to see value in it. I interpret this to mean he gains attitudes and feelings regarding the topic under study. Now would someone on the panel please comment if he agrees with this and that one cognitive domain objective would suffice, or does he think there needs to be separate objectives (cognitive and affective).

Dr. Tyler: Dr. Simpson, this sounds as if it is down your alley.

Dr. Simpson: I will try. It seems to me that for every objective in the cognitive domain we have one or more in the affective domain. Whether we state the affective or not, it is there. It is understood. I find it helpful to state both the cognitive objective and its related affective objective(s).

For example: for almost every knowledge objective, I think you have a related interest objective, but I do not know whether you necessarily achieve this objective in the affective domain because you have achieved the objective in the cognitive domain. It seems to be questionable.

Dr. Tyler: You have opened up a very interesting field, and that is the field of values. Where do you use media for achieving values? The only thing that I can think of off-hand is that it seems that some of the media like radio, sound recordings, television and video tape would lend themselves to the presentation of dramatized problems and situations which involve problems of values. I could see these being produced by either commercial producers or by state departments for use over a wide area because effective dramatization is a rather expensive thing for people to produce on their own. Do any of you have ideas about the use of media to obtain objectives in the realm of values?

Dr. Jensen: One of the issues that we might raise here is that we have been trying to grapple with this problem of values with young people. We have found over the years that we do not get very far by telling people that they should have certain values. This has not been very successful. I would suggest, theoretically at least, that media lend themselves very greatly to the process of inquiry, which seems to be a much more valuable way of getting at internalization of values. Therefore, whatever media structure we might use, if we would tend to think of it in lines of an inquiry approach, it might lend itself to this internalization process.

Dr. Tyler: Next, anyone?

Mr. Levendowski: I have a question for Dr. Simpson. Concerning some of the objectives that you gave us, do you feel they are specific enough in terms of what we have heard in the past few days about designing curricula? How specific should we be in designing our instructional objectives?

Dr. Simpson: We have been discussing this question in an evaluation course this summer. My own notion is that it is not too important if you know what you mean and if you are going to do the teaching. Thus, you might state educational objectives in rather broad terms, and I think there is a place for these global objectives--also recognizing the subobjectives that relate to them--if you are aware of this. It is probably helpful to most of us to state them--to be quite specific. I think that the ones I gave were, for the most part, fairly specific. Whether they need to be preceded by such phrases as "to develop" and so on, is a good question. Robert Mager would say that some of these are not specific enough, but I am inclined to think some of them that are fairly broad are specific, if you know what you mean by them and if you are the one who is going to follow up with it. We found it has been helpful to state the objectives and then classify them, and in the process of classifying, clarification has developed about what was meant by the objective. Sometimes the objective was then restated so that it was more specific.

Dr. Tyler: Dr. Simpson, when you break down objectives so that they are quite specific in terms of the kinds of accompanying behavior you want, does this make it easier to select the appropriate materials or media with which to engage the students to achieve the objectives?

Dr. Simpson: Oh certainly, I think so. The more specifically they are stated, the easier it becomes to determine related content or experiences, etc.

Dr. Tyler: This, of course, is the great advantage of being specific about the kinds of behavior you want to obtain.

Dr. Simpson: Of course, this is the very reason for the taxonomies of educational objectives. They help you to be more specific.

Dr. Tyler: Any other comments or questions?

Mr. Levendowski: I was just wondering if Dr. Simpson would elaborate a little more about this fourth domain that she mentioned.

Dr. Tyler: He wants you briefly to develop the fourth domain which you did not really develop.

Dr. Simpson: I think the diagram helped explain what we mean by this. There are some objectives that have some components of affect and cognition, some that have both cognition and psychomotor involved, and some psychomotor and affect. These were tied together in the overlapping diagram and in the middle we had some objectives--broad global objectives which include elements of all three domains--and I do think they have a place along with the more specific ones. You can even lose sight of some of the big things by just dealing with these very specific objectives. These big, broad objectives might be termed "action-pattern", and we see them as objectives that involve cognitive affective-psychomotor activity. Here, one of the relevant questions is what is the inner relationship among these? Within these objectives, which predominate? This might be another kind of question one might pursue: How do these objectives relate to smaller ones? There is a whole area here that needs exploration.

Dr. Tate: I would like to know if any panel member has experimented with the 8 mm cartridge medium, and if so, with what domain might these be appropriate?

Dr. Tyler: He is asking about the 8 mm cartridge film, and more specifically, what kinds of objectives, with what domain, have been found to be successful?

Mr. Levendowski: There are a number of research projects going on at present that have made extensive use of single-concept films. There is one being conducted at Washington State University in the area of industrial education; work is also being done in the area of speech using this media.

Dr. Tyler: We ordinarily think of the single-concept film either as teaching a very specific, small skill, or used where something is explained or diagrammed. If you want to see a specific skill performed, you can see it several times in a cartridge film. The film deals with a single idea or concept from which the single-concept notion came. When something is explained or diagrammed, you can see it over and over again until you grasp it. I am sure applications of the single-concept film would fall in many fields of vocational and technical education. Yes, please.

Seminar participant from the floor: To what extent do you advocate flexibility in the objectives within any one of these domains to the extent that the learner is encouraged to have this creativity?

Dr. Tyler: I think that is directed at you, Dr. Simpson. I am not sure about the meaning of the term flexibility--whether it refers to the levels of performance that vary according to the background of the individual. Perhaps you could clarify what you mean?

Seminar participant: I wish to know if once the objectives are set for a particular course of study or period of time, are they so fixed that they must remain that way, or are they ever-changing?

Dr. Simpson: This is a very interesting question. I will comment as I see fit, although I am not sure I am fully answering the question. To what extent does this inhibit the student's developing and stating his own objectives? I think it does, unquestionably, because if you have a sequence here--if knowledge is basic to comprehension, to application, and so on--this suggests a sequence in learning experience, doesn't it? The student's felt-needs and interests may be someplace else. I think there isn't any decision made without some dissonance. Either you deal primarily with a student's felt-needs and interests, or you set up the objective and have a very ordered development. I think there is a balance that can be achieved between the psychological and the logical. Using this schema gives an edge to the logical development, and I happen to think this is sound--out of my own reading and experimentation. I think with the abundance of knowledge we have today, we cannot use the technique of permitting students to develop and state their own objectives as we thought we could in the forties. I think there has been a distinct change here. I know what I am saying is very controversial, but it seems to me this does give an edge to organization and structure. You may not like it, but if we are to have efficiency in learning all there is to be learned. choices have to be made, and this does give us some basis for making choices. It does not rule out the possibility of the student's participation in terms of his own interests and needs.

Dr. Tyler: This may suggest that within the total curriculum you may have some areas which are highly programmed, highly mandatory, such as you are indicating, and this very fact may mean that in other areas of the curriculum there has to be much more freedom. We are already getting rebellion from young people against the IBM card and the regimentation, the talking face on the television screen, and so on, which represents to too many of them the big university at the freshman level. I think there is a very good point here about the implications of completely formalizing education and putting it in steps as in programmed instruction.

Dr. Brandon: Dr. Tyler, may I reveal this kind of a problem? I do not know whether anyone else is thinking this way or not. It strikes me that Dr. Simpson and her colleagues have done a tremendous amount of analytical work, put a tremendous amount of effort in this; however, I cannot see my way out of the woods through this analysis of objectives, our analysis of curriculum, and our analysis of desirable direct-work experience--the latter which we prided ourselves on for the last half century as being the best type of learning. Now you will immediately note that I am pro-experience centered, and I will say you are right. At this moment, I do not know how to back off from the direct work experience as against the contrived one--as against one used by a certain type of medium or media. Am I lost in the woods on this hopelessly, or where do we go on the basis of this kind of organization of objectives and curriculum?

Dr. Tate: May I speak to that? I would say that as a business educator, I am in agreement with Dr. Brandon to a great extent. If we turn out an office worker or somebody who can handle an office occupation, that is the overall objective. If we do analyze all the objectives, we can neatly state them, but I believe that analyzing objectives can go too far. In training an office worker, it may get in my way if I spent too much time analyzing all the objectives. Such an analysis would be very nice, but I think we do and have done an unconscious analysis for a long time. If we are training somebody for an on-the-job spot, we work from the simple to the complex.

But I am sure if we take so much to analyze objectives that we are going to get our workers trained.

Dr. Tyler: There are a couple of very fundamental questions that have been raised here. One is whether the process of being very specific about objectives interferes with the actual experience on the job which has been one of the high points of vocational education. The other issue here seems to be whether or not defining specific objectives, however derived, and programming for their achievement interferes with creativity. Perhaps it is a matter of choice among the many alternatives. This includes the questions: what proportion shall be direct on-the-job experience for its obvious values; what proportion shall be contrived, simulated, second-hand experience--brought in, in order to broaden the student's understanding in the cognitive and affective areas--in order that he may be better able to adjust to the kind of changing civilization in which we live. At present, a preparation for a specific job may not be adequate for him five years from now. However, these issues will have to be discussed. Somebody has a question back there. Yes.

Seminar participant from the floor: I would like to address this to Dr. Brandon. Would you please comment on the role of the instructor in the learning process for the affective domain such as standards, discipline, and tolerance within the trade and technical area?

Dr. Brandon: I think this is related to the question I was generally asking. If you are in trade and industrial education you have been accused with me and many others of a violation of these kinds of value patterns. Furthermore, over many years, the accusation has been that, "You guys in T & I are just too well organized. You are organized up to the teeth. You have analyzed the daylights out of your curriculum, based on a very formal job analysis, and if we read this, we find no place, no evidence, no mention of, desirable work characteristics or values." This is a traditional criticism of our work. This is what led me to ask Dr. Tyler a moment ago, "How do I reconcile this tremendous amount of analysis on our part with the overwhelming analysis exemplified in what Dr. Simpson has been showing us, and come up with any kind of a priority for recognizing what you are talking about as desirable things to be taught in the eyes of the individual instructor--to say nothing whatsoever about individual differences." Now I have answered your question with another one, I know. Maybe I am saying to Dr. Tyler that we might have to learn more discrimination. We have to recognize that the sociology of occupations in itself is changing. We cannot continue to put all of our work in psycho-motor development--as attractive as this area has become with Dr. Simpson's description of it and its closeness to our hearts in trade and industrial education. We know that psycho-motor skills unfortunately are disappearing from many T & I occupations.

Dr. Tyler: This is a good note to close on. I would remind you that we are ending with problems and this means you have to do more thinking about them so you cannot forget this session now that it is over.

EDUCATIONAL MEDIA UTILIZATION FOR COGNITIVE, AFFECTIVE AND PSYCHOMOTOR LEARNING

Interest Group Session

Dorothy Jackson,[1] Chairman
Elizabeth Simpson,[2] Consultant

The interest group session was initiated by the chairman's summary of the main concepts that were derived from the speaker's and panel's presentations. The four domains were reiterated with special emphasis for the application of the educational media to achieve the educational objectives emphasized in Dr. Simpson's address. Of special concern was the relationship of the cognitive-affective domains. Fear was that overemphasis has been attached to the cognitive and psychomotor areas in vocational and technical education (i.e. techniques and accumulation of basic knowledge) with de-emphasis of the affective-value laden area. Reevaluations of broad as well as specific goals are necessary so that all the domains should be included to insure the broad-based, knowledgeable citizen who has inculcated the values of his culture and attitudes of his society.

Advantages of the System

The advantages of a taxonomic form of classification of educational objectives are: to facilitate the evaluation of goals in curricula development; to gain perspectives on the emphasis given certain behaviors; to increase the exchange of ideas; and to suggest the kinds of objectives to be included for the development of skills, knowledge, values, interests, and attitudes. The needs of the community and the goals of the school can be correlated to ascertain whether there is a value congruency and to determine whether there has been an effort made to internalize those aspects of the student's environment that will enable him to appreciate, understand and feel the worth of something, as well as teach him the knowledge and the skill for its use.

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[2] Dr. Simpson is acting chairman, Department of Vocational and Technical Education, College of Education, University of Illinois.

This group stressed the need for a multi-media approach used simultaneously, intermittingly or consecutively in order for all the domains to be developed. The use of film clips must be followed by some discussion, participation, socio-drama, or interchange of ideas by students and instructor so that the cognitive area will be supplemented by the affective response. A TV film stressing the cutting of a dress pattern in home economics (a cognitive and psychomotor domain) can be approached from the affective viewpoint to help the student appreciate the beauty and craftsmanship that results from a job well done.

Disadvantages of the System

The disadvantages of using any system is that care must be stipulated to make a distinction between teaching and instruction--educational media help in instruction but teaching includes all the domains as well as motivation, identification, enthusiasm, interchange of ideas, and takes into consideration individual differences and needs. Media are tools and must never become ends unto themselves.

Values of the System

The values of educational media and their best application can be achieved in vocational and technical education objectives. The teaching of office skills (psychomotor and cognitive areas) must include value teaching. Some areas within the curriculum are highly programmed, with maximum use of media, whereas others have a flexible method of instruction. We must not forget that telling or instructing by programmed media will never be successful if the individual is forgotten in the educational process. There must be an affective response in order for the values, aesthetics, interests and appreciation of his knowledge and skills to be of use to him. The expert use of office machinery does not assure an office worker of success if he does not have the proper attitudes necessary to function in an office environment and in many instances the adequate skill level does not guarantee him of a permanent position with that company. Knowledge derived from microfiche does not create a knowledgeable person if he only absorbs and stores this information without any personal reaction, involvement, or evaluation of what he has read. A proper mental, physical and emotional set is required in order for the media used to gain its full potential in the education process.

THE LEARNING SYSTEMS APPROACH TO INSTRUCTION AND THE CHANGING ROLE OF THE EDUCATOR

Donald K. Stewart[1]

Our society in the United States expects educational institutions to carry out at least the following three functions in regard to their students:

1. to prepare the students in such a way that they will have an even happier and more successful life than their parents;

2. to be sure that the experiences necessary for each student to achieve the first function happens by choice--not by chance;

3. to develop each child to the maximum of his capability.

These three functions have been stated in many ways by many different people and may be found in most educational institution charters or constitutions. They sound great, but the goals implied by these three statements are not being achieved. It is possible to fulfill these functions through the use of available technology and methodology to the extent that 90 percent or more of our students learn 90 percent or more of the specified objectives of appropriate courses.

THE LEARNING SYSTEMS CONCEPT

A 'learning systems" approach is an effort to organize and condense necessary or desired experiences as consisely and systematically as possible so as to increase the probability that learning will occur and in an efficient manner. A learning systems concept when applied to educational or training courses offers an opportunity to develop or rebuild these courses to be significantly more effective and efficient in relation to the learning tasks and goals of students.

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[1] Dr. Stewart is director, Systems for Learning by Application of Technology to Education (SLATE), Westminster, California.

The development of an educational or training course utilizing a learning systems concept includes the steps that are followed when preparing materials for programmed instruction.[2] The extra steps are necessary in order to apply a systems concept to the process.

The development of an educational or training course is divided into two major stages: the behavioral analysis of the course content or the pre-construction stage and the synthesis of the course construction based on desired learner behavior[3] or the construction stage.

In the behavioral analysis, the most important task is to specify definitively the learner behaviors and learning objectives in order that the nature of the behavior is revealed, past learning can be measured, behaviors to be modified are identified, and the objectives can be communicated.

The development of a typical course during this first stage follows a particular sequence of events designed to analyze and delimit the course content.

1. The first step in the analysis is the specifications of the terminal behaviors[4] for the course. After

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[2] Programmed instruction, referred to also as programmed learning, auto-instruction, teaching machines, etc., refers to the utilization of programmed materials (a program) to achieve educational objectives. A program consists of a sequence of carefully constructed items leading the student to mastery of a subject through self-study. The change from programmed instruction to the "learning systems concept" is a matter of greater degree of sophistication. The name change is necessary because "learning systems" is more descriptive of the process involved and because the stereotype already established by those familiar with the term "programmed instruction" limits the mode of presentation to some kind of verbal format presented in a textbook form or by a teaching machine. "Programmed instruction" does not evoke the same meaning to those unfamiliar with the term as to those who are familiar with it. In fact, people who are unfamiliar with the term, upon hearing or seeing it, often confuse it with computer technology.

[3] Learner behaviors are anything that a student does purposely in response to an appropriate stimulus and which results in publicly observable and measureable activities, e.g., writing, speaking, performing, etc.

[4] Terminal behaviors are those behaviors which the course instructor wishes the learner to exhibit upon completion of a course and as a consequence of the course content. (See Appendix I.)

each terminal behavior (objective) is stated, the following three questions should be asked:

a. Why should the student learn this behavior?

b. What is the student supposed to do with the behavior once he has attained it?

c. How long should the student retain the behavior after once attaining it?

Answers to the first two questions could affect the inclusion of the objective in the course content and answers to the third question could affect the design of the instruction materials.

2. The construction of a post-test is the next step, and it will enable the observer to determine whether or not the terminal behaviors can be exhibited by the learner.[5]

3. The third step is the specification of the assumed entry behaviors[6] of representative learners who would take the course and the relevant characteristics[7] of these learners.

4. The fourth step is the construction of a pre-entry test that will enable the observer to determine whether or not the assumed entry behaviors can actually be exhibited by representative learners who would take the course.

5. The fifth step is the specification of learning objectives of the course which will be achieved through learning experiences and convert the learners' entry behaviors into terminal behaviors.

6. The sixth step is the construction of a pre-test that will enable the observer to determine which of the learning objectives of the course content, if any, have been learned previously by representative learners.

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[5] Usually a slight change in the wording of the specified behavior will result in the test item for this behavior. (See Appendix II.)

[6] Entry behaviors are those behaviors pertinent to the course content that are exhibited by prospective learners of the course. (See Figure I.)

[7] Characteristics that could affect the presentation of course content, e.g., IQ level, educational background, etc.

have been learned previously by representative learners.

7. The last step of the analysis is a preliminary tryout of the pre-entry test, pre-test, and post-test on a sample of students that are representative of the intended learners for the course.

In testing out the units or total courses which have been developed, the developer has to be especially aware of individual differences. There are five major learning variables which should be kept in mind as being contributing factors to individual differences.

1. Rate of learning
2. Amount to be learned
3. Mode of learning
4. Interpersonal relationaships in learning
5. Motivation to learn

The fact that students 1) learn at different rates is probably accepted by most teachers because of the evidence resulting from programmed instruction research. The problem is that while most teachers agree that students learn at different rates, their teaching behaviors in the classrooms denies this fact.

The 2) amount to be learned varies from student to student. The only way the amount to be learned can be identified is through the use of pre-entry tests,[8] and post-tests (See Figure 1).

For example, student "A" has the right entry behaviors for the course and doesn't know any part of the course. Student "B" needs some remedial work before he can start the course. Whether or not student "B" takes his remedial work prior to the course or concurrently with the course depends upon the subject matter, the student, and the dependency of course on the student's knowledge of prerequisite material.

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[8] During the behavioral analysis stage, the pre-entry test, measuring wnat the student's experiences prior to the course were, and the pre-test, measuring the student's knowledge of the course content, are kept as separate tests. In the "real world" after the course materials have been developed, tested, and revised, the pre-entry test and the pre-test are combined into one unit and referred to generally as a pre-test.

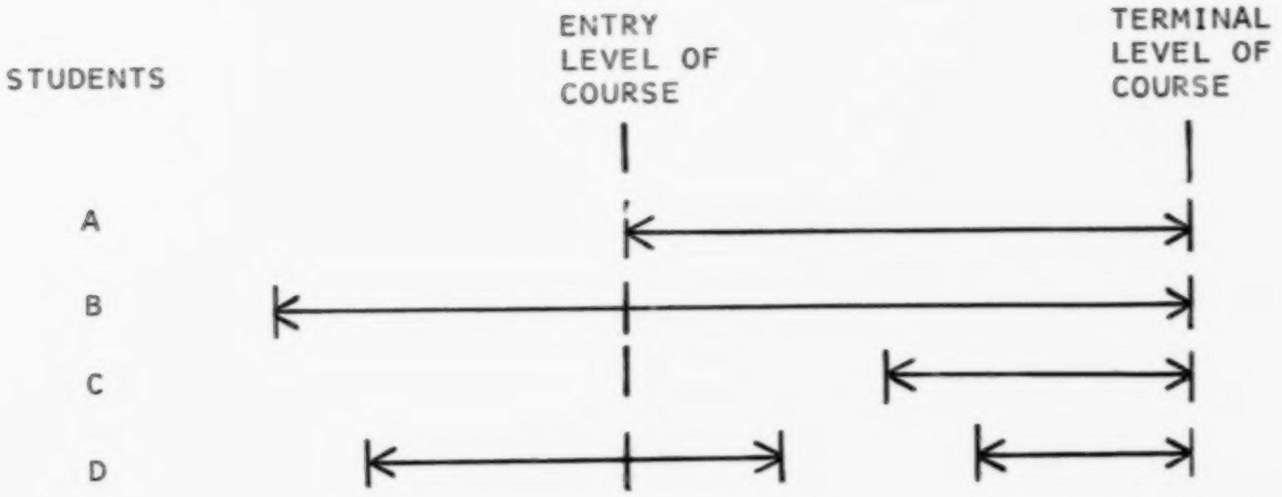


FIGURE 1--Amount to be Learned

Student "C" knows most of the course and in most instances would probably be wasting his time and the teacher's time if he were to go back through the material in the course he already knows. Student "D" is more likely to be typical of most of the students today. He needs a certain amount of remedial study and in addition he already knows a considerable part of the course. Some kind of branching is indicated in dealing with students like "C" and "D".

The variable concerning the 3) mode of learning is very important. As teachers, we make certain assumptions about how students learn which may in fact reflect more about how we teach than how students learn. We must remember that as individuals some of us may learn best by one mode and others by some other mode. Therefore, it will be of value to refresh our memories by examining various modes of learning. For the purposes of this paper where the same set of one or more related objectives can be learned from various modes of presentation in a synthethic situation in addition to being able to be learned by chance in "real life", then the various modes of presentation will be considered a "simulation" of the real life situation.

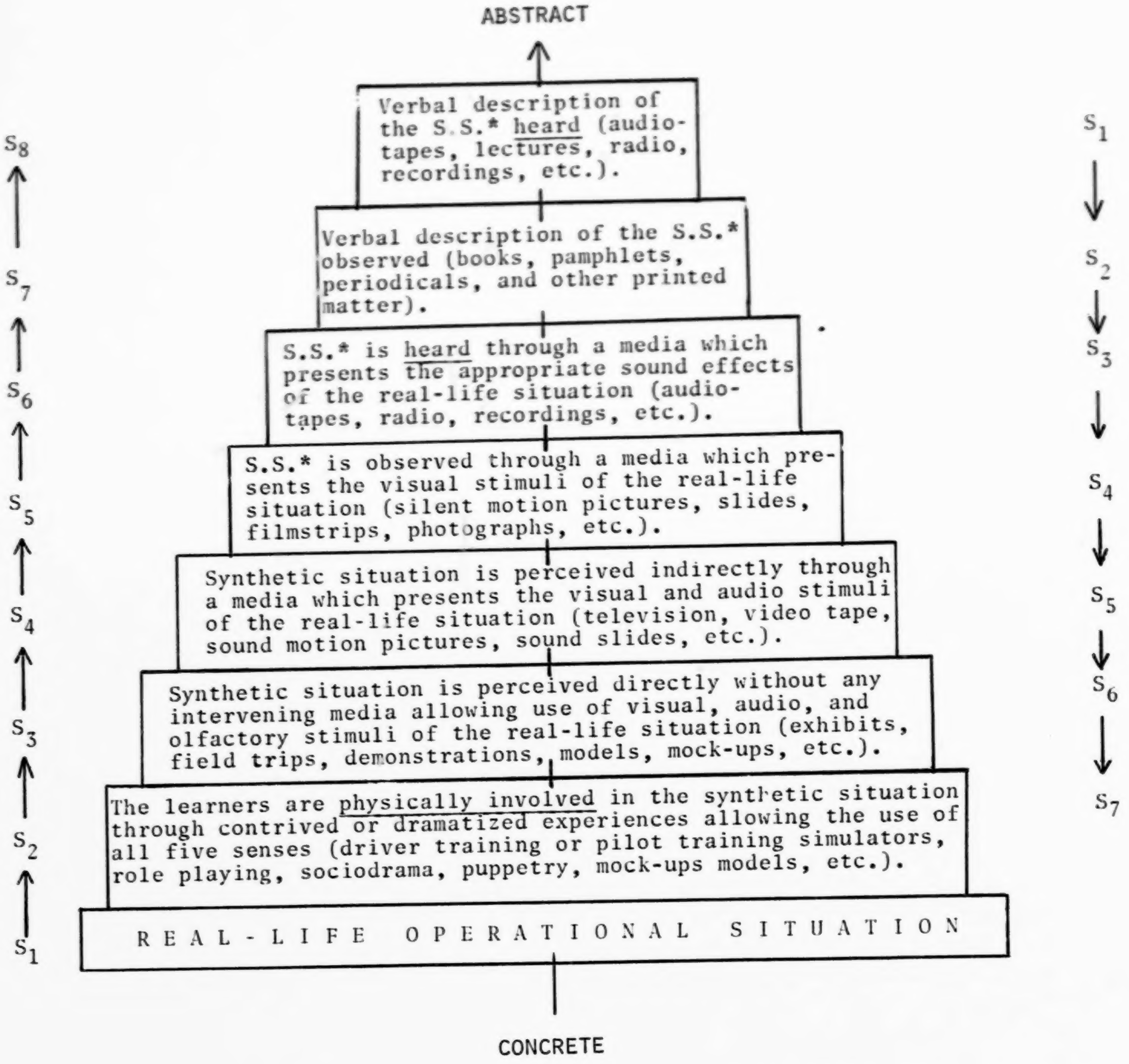
In setting up a synthetic situation, various instructional media and varied methods of utilizing them can be integrated to varying degrees, giving a flexibility in the means of the desired simulation. It is important to remember that a particular synthetic situation (simulation) which involves a variety of instructional media should be designed in accordance with the predetermined learning objectives and not according to the characteristics of the instructional media. In other words, fit the media to the objectives, not the objectives to the media.

Figure 2, which shows a variety of instructional media placed on an abstract-concrete continuum in the form of a pyramid, can be used as an aid in the selection of media to fit certain objectives. The placement of a specific medium in a specific tier is based on the general use of the medium; the number of senses involved; whether the synthetic situation is observed, heard, or both; and whether the perception involved is the synthetic situation or a verbal description of the synthetic situation. It is relatively easy to affect the placement of a specific medium by incorporating into it some new features or characteristic that would relate to the criteria used for deciding placement on the diagram, e.g., adding sound to filmstrips would move the combined media to the tier below.

A fourth learning variable, 4) the interpersonal relationships in learning, has just become evident in the past several years. Actually, many people have been aware of this variable for years, but little, if any, effort has been made to classify it as a learning variable and to take it into account in the learning situation. This particular variable became especially noticeable in a programmed instruction project in which it was noted that not all students liked a particular programmed text but if given a choice of three programmed texts covering approximately the same content, each student was able to choose a text that he liked and also could learn from.

Why do we expect the learners to all like the same author of a programmed text or a regular textbook or even to like the same classroom teacher? Many parents have had the experience of having one of their children in the classroom of a particular teacher and the child loved the teacher and learning took place. Later on a younger brother or sister was assigned to the same teacher, this child did not like the teacher and learning did not take place. What is so important about making children use the same text or staying with teachers they do not like and connot learn from? Are we worried about the problems in paperwork or administration? If our ultimate goal is learning, then whatever will facilitate learning should be a part of the system. If a student is not learning and a change in the textbook or a change in the teacher does result in learning, then why not do it!

The fifth learning variable, 5) motivation, has been the topic of many conferences during the past two decades. For the purposes of this presentation it is enough to say that in general, educational institutions and educators are not paying enough attention to the need for motivation to stimulate learning. The concept of motivation is like the concept of individual differences, almost all educators will agree that what will motivate one child will not necessarily motivate another, yet in the classrooms, we continue to assume that all



Verbal description of the S.S.* heard (audiotapes, lectures, radio, recordings, etc.).

Verbal description of the S.S.* observed (books, pamphlets, periodicals, and other printed matter).

S.S.* is heard through a media which presents the appropriate sound effects of the real-life situation (audiotapes, radio, recordings, etc.).

S.S.* is observed through a media which presents the visual stimuli of the real-life situation (silent motion pictures, slides, filmstrips, photographs, etc.).

Synthetic situation is perceived indirectly through a media which presents the visual and audio stimuli of the real-life situation (television, video tape, sound motion pictures, sound slides, etc.).

Synthetic situation is perceived directly without any intervening media allowing use of visual, audio, and olfactory stimuli of the real-life situation (exhibits, field trips, demonstrations, models, mock-ups, etc.).

The learners are physically involved in the synthetic situation through contrived or dramatized experiences allowing the use of all five senses (driver training or pilot training simulators, role playing, sociodrama, puppetry, mock-ups models, etc.).

FIGURE 2--Simulation Through Use of Instructional Media

*Synthetic Situation

children are motivated to do the same learning tasks and projects and that there are no individual differences. Frank Brown, principal of Melbourne (Florida) High School, states that there is nothing so unequal as giving unequal students equal materials and expecting equal results. There are essentially two types of motivation; intrinsic motivation and extrinsic motivation. Intrinsic motivation results from developing instructional materials which so interest the learner and are so meaningful that the learner wants to work with them. Extrinsic motivation results from designing rewards into the learning situation such that the rewards for achievement are sufficient enough to encourage the learner to go through a learning situation which is of little immediate interest and relatively meaningless from the learner's point of view.

ROLE OF THE TEACHER

In the typical classroom situation, where the teacher is the presenter of information, the teacher is generally the focus of attention. When courses, developed in accordance with the learning systems concept are introduced into the classroom and replace the teacher as the presenter of information, learning becomes the focus of attention. The teacher who has now been relieved of the time-consuming task of presenting the same information semester-after-semester and year-after-year, can concentrate on the task of teaching. The teacher becomes an educational diagnostician, a director, or a guide to meaningful learning experiences--adapting available materials and environment to the needs of the learner. The teacher's role in the teaching-learning situation can consist of four functions:

1. present course content to the students;
2. solve student learning problems;
3. diagnose student learning problems and prescribe appropriate learning experiences; and
4. up date the course content and evaluate course materials.

Most teachers today are so busy with the first function that they haven't time to be aware of the other three functions. The most important contribution a teacher can make to the teaching-learning situation is to bring about the desired learning regardless of who or what does the presenting of the course content.

The second function, solving learning problems, should be an integral part of every teacher training institution's curriculum; but to the knowledge of the author of this paper, there are only two or three schools in the country that attempt to teach and to practice the process of solving learning problems. For that reason, the author of this paper conducts one-week institutes at various locations around the country during which the institute participants are involved in identifying the solution or solutions to one of their own classroom learning problems. The practical goal of these solutions is to enable 90 percent or more of a teacher's students to learn 90 percent or more of the content of what was previously a learning problem.

CONCLUSION

Through the learning systems concept, there is an unusual opportunity to rebuild courses more effectively and efficiently, not just to remodel them. In doing this rebuilding, it is of paramount importance to be creative in the application of the various media as long as it contributes to the effectiveness and efficiency of the learning situation.

Realizing that the use of the total learning systems concept involves a lot of time, effort, and money, and in order to facilitate educational innovation, the following statements are seven aspects of the learning systems approach that can be adapted easily into on-going courses without the teacher having to accept or utilize the total learning systems approach.

1. Try to specify more specifically the course objectives without using such vague and non-measurable terms as understanding, appreciation for, familiarity with, a knowledge of, etc. The use of Robert Mager's book on Preparing Objectives (1962) has been very helpful to many educators in the formulation of specific objectives. A ready-made list of course objectives are the test items on presently used unit and final examinations. Just as it is possible to make test items out of specific objectives by a slight change of wording (see Appendix II), it is just as possible to make specific objectives out of test items. The more a teacher specifies the course objectives, the easier it will be to communicate the course content to the students, and the more the students will learn.

2. Try to develop pre-tests which will help the teacher and the student to know "where the student is" in regard to the course content. Find out if students need specific remedial work or if they need advance placement. A ready-made source of a pre-test would be a combination of a final examination from a prerequisite course or courses (just using the test items that are pertinent to the course for which you want the pre-test) plus the first major test in the course itself (six or nine week examination). In this way, it is possible to measure "Does the student have the necessary knowledge and skills to take the course?" and "Does the student already know part of the course?"

3. If a teacher cannot or does not want to take the time to specify the course objectives, then the very least that a teacher can do is to specify the "critical objectives" of his course. "Critical objectives" are learning objectives which if the students do not learn them they will be unable to learn certain course content in subsequent courses. Every teacher should try to identify these "critical objectives" and students should not be permitted to pass on to the next course without them.

4. Try to look on students' errors as possible indications of learning problems and as opportunities to teach. Did you, as a student, ever answer a test item wrong on purpose? Outside of a few rare instances, most students try to answer test questions to the best of their knowledge at the moment. If in fact the students are wrong, then it may be of value to check into the learning situation and find out why the students answered wrong. Maybe the objective was not taught right!

5. Try to make sure that tests are valid and that they actually measure the behaviors that represent the learning objectives of the course. Also, make sure that the tests only test behaviors which the student has had an opportunity to learn (no hidden objectives). For example, if a teacher wants a student to learn specific facts or wants the student to learn how to deal with facts in certain ways, the use of a multiple-choice test may not identify whether or not the student learned these objectives. Multiple-choice tests usually measure a student's ability to discriminate

between answers (process of elimination) rather than if he knows a specific item or skill.

6. Try to be more aware of the five learning variables discussed earlier in this paper concerning individual differences.

    a. rate of learning,
    b. amount to be learned,
    c. effect of interpersonal relationships on learning,
    d. mode of learning, and
    e. effect of motivation on learning.

7. Try to change your personal educational philosophy from that of one who is mainly concerned with presenting course content to that of one who is mainly concerned with student learning.

In education, students come to teachers in order to learn. Generally, if the student does not learn by whatever method the teacher uses, we have been essentially saying, "Too bad, you fail!" Most educators are not sufficiently concerned when the cumulative effect of failures may cause students to drop out of school with the resultant loss in potential lifetime income of tens of thousands of dollars. As teachers, do we really have the right to have such a drastic effect on students' lives without trying to help the students learn? Are we giving up too readily when our students' future and their families' future is at stake?

APPENDIX I

SPECIFICATION OF LEARNING OBJECTIVES

Some teachers believe their students should "really understand," others desire their students to "internalize knowledge," still others want their students to "grasp the core or essence" or "comprehend." Do they all mean the same thing? Specifically, what does a student do who "really understands" which he does not do when he does not understand? All too frequently educational objectives are stated as meaningless platitudes and cliches. If educational objectives are to give direction to the learning process and to determine the nature of the evidence to be used in appraising the effects of learning experiences, the terminology must become clear and meaningful. The ideal, of course, would be educational objectives stated so clearly that the authors of the objectives would know exactly what they meant and the readers of the objectives would have an equally clear idea of what was intended.

Examples of the Usual Way of Writing Objectives	Examples of Specific Measurable Learning Objectives
Familiarity with a large number of words in their common range of meanings.	To be able to define in two or more ways each of the following words: ....., ..., ..., ..., etc.
The possession of a minimum knowledge about the organisms studied in the laboratory.	To be able to list the similarities, differences, functions, and to recognize each of the following organisms: ....., ..., etc.
Familiarity with the forms and conventions of the major types of works; e.g., verse, plays, scientific papers, etc.	To be able to recognize and discriminate between the forms and conventions of these five major types of works: ....., ..., ..., ..., ...
To make pupils conscious of correct form and usage in speech and writing.	To be able to recognize correct and incorrect form and usage in speech and writing of the following words and phrases: ....., ..., etc.

Examples of the Usual Way of Writing Objectives	Examples of Specific Measurable Learning Objectives
Understanding of the continuity and development of American culture as exemplified in American life.	To be able to list the developmental stages and changes of the following four areas of American culture from 1700 to 1950: ....., ..., ..., and ..... To be able to write an essay on how these four areas of American culture are exemplified in the American way of life today.
Becoming familiar with a range of types of literature.	To be able to identify the following literary excerpts by listing the author and title of the piece of literature it was taken from; by discussing what occurs in the literature prior to and after the excerpt; and by classifying the piece of literature as being ....., ..., or .....

APPENDIX II

DEVELOPING TEST ITEMS FROM SPECIFIC LEARNING OBJECTIVES

The examples below demonstrate the slight change of wording that changes specific learning objectives into test-items.

Specific Learning Objectives	Test Items
To be able to identify and discuss the limitative factors of the classification or category typified by the following problems and materials: ....., ..., ..., etc.	Identify and discuss the limitative factors of the classification or category typified by the following problems and materials: ....., ..., ..., etc.
To be able to list and discuss the sequence of events followed in the scientific methods for evaluating health concepts.	List and discuss the sequence of events followed in the scientific methods for evaluating health concepts.
To be able to list and define the following scientific terms and concepts: ....., ..., etc. To be able to iterate the phenomena as presented in the following papers utilizing the above listed scientific terms and concepts: ....., ..., etc.	List and define the following scientific terms and concepts: ....., ..., etc. Iterate the phenomena as presented in the following papers utilizing the above listed scientific terms and concepts: ....., ..., etc.
To be able to identify and state the unstated assumptions assumed in the following messages: ....., ..., etc.	Identify and state the unstated assumptions assumed in the following messages: ....., ..., etc.
To be able to identify the following statements as being statements of fact or hypotheses: ....., etc.	Identify the following statements as being statements of fact or hypotheses: ....., etc.
To be able to identify the consistency or inconsistency of the following stated hypotheses with the accompanying information and assumptions: ....., ..., etc.	Identify the consistency or inconsistency of the following stated hypotheses with the accompanying information and assumptions: ....., ..., etc.

Specific Learning Objectives	Test Items
To be able to list the interrelationships among the ideas in each of the following passages: ....., etc.	List the interrelationships among the ideas in each of the following passages: ....., ..., etc.

REFERENCES

Mager, Robert F. *Preparing Instructional Objectives.* Palo Alto, California: Fearon Publishers, 1962.

PART III - THE CHANGING EMPHASIS IN EDUCATION AND THE NEW MEDIA

A. THE LEARNING RESOURCE CENTER

THE LEARNING RESOURCE CENTER AND CHANGING EMPHASES IN EDUCATION

Mendel Sherman[1]

The term "learning resource center" should, could and occasionally does, mean something different from an audio-visual center, a teaching aids laboratory, an instructional materials center, a department of educational communications, a center of instructional technology or a bewildering host of other terms frequently encountered in educational institutions of all levels and sizes. In actual practice, however, there seems to be as much difference among centers which have the same name as there is among those which have entirely different designations. Usually a learning resource center alludes to a facility where all types of media for learning and instruction are obtainable and used whether locally produced or otherwise procured.

Ordinarily both print and non-print media are considered the province of the learning resource center--media such as books, microfilm, motion pictures, recordings and in fact the entire gamut of media, accompanied by all of the technological instrumentation and processes with which they are associated. Included also are the human resources and services that are needed to achieve adequate utilization of the media. Actually, it is extremely difficult to provide a definition of a learning resource center which establishes a meaningful parameter. What media and services would be included? or excluded? Someone facetiously suggested that attempting a definition by exclusion would be similar to carving an elephant by taking a block of material and cutting away anything that didn't look like an elephant. If this were the approach to the learning resource center there could hardly be a single cut because anything can become a medium of instruction or for learning depending upon purposes and specific objectives.

Some have looked to Dale's Cone of Experiences as one source for deciding what might be the realm of the learning resource center. Dale's Cone is an arrangement of experiences from direct purposeful experiences at the base to verbal and visual symbols at the peak. Thus it ranges from the most concrete to the most abstract.

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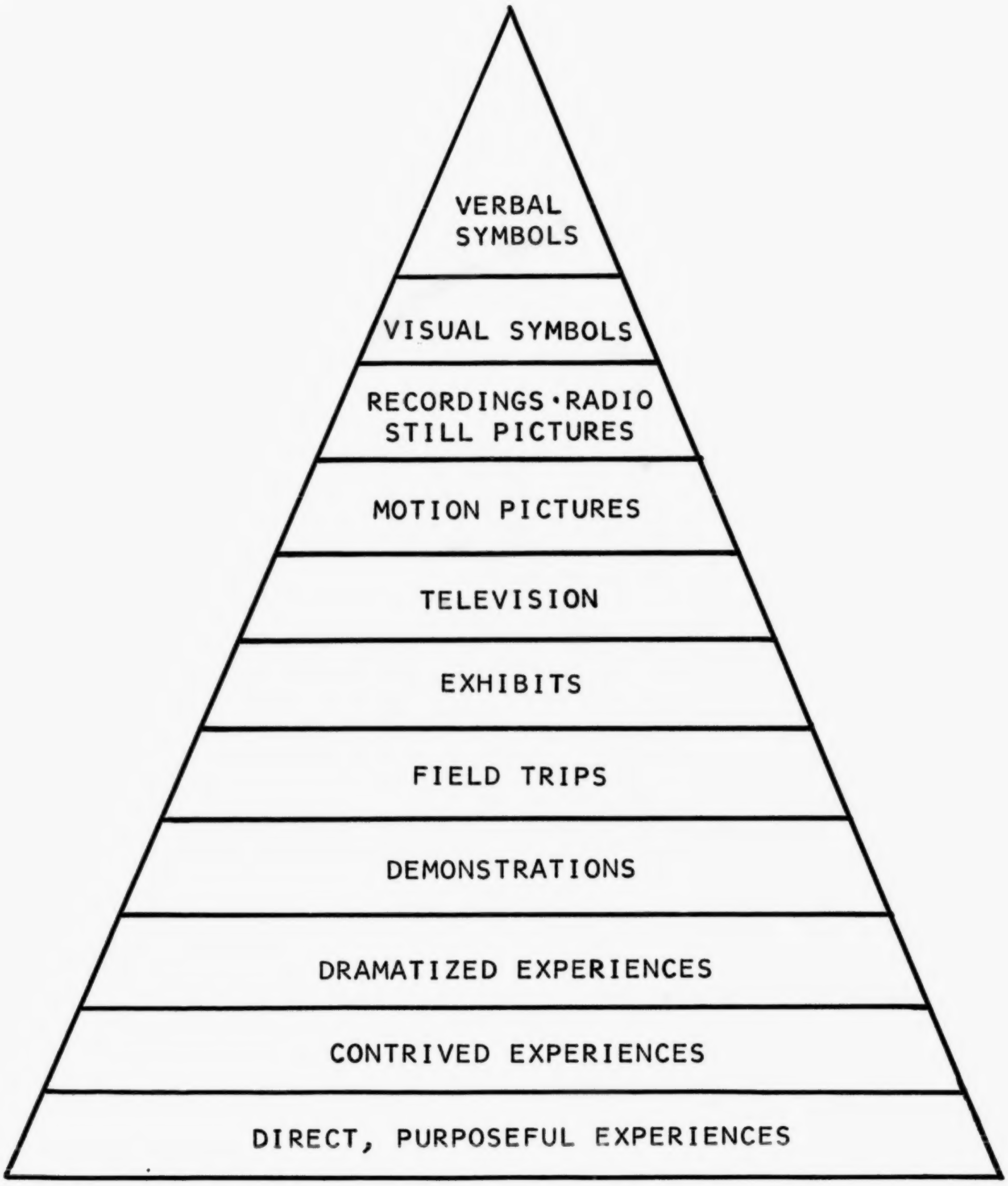
[1] Dr. Sherman is professor of education, assistant director of the Audio-Visual Center, and Indiana University area coordinator for the Midwest Program on Airborne Television Instruction.

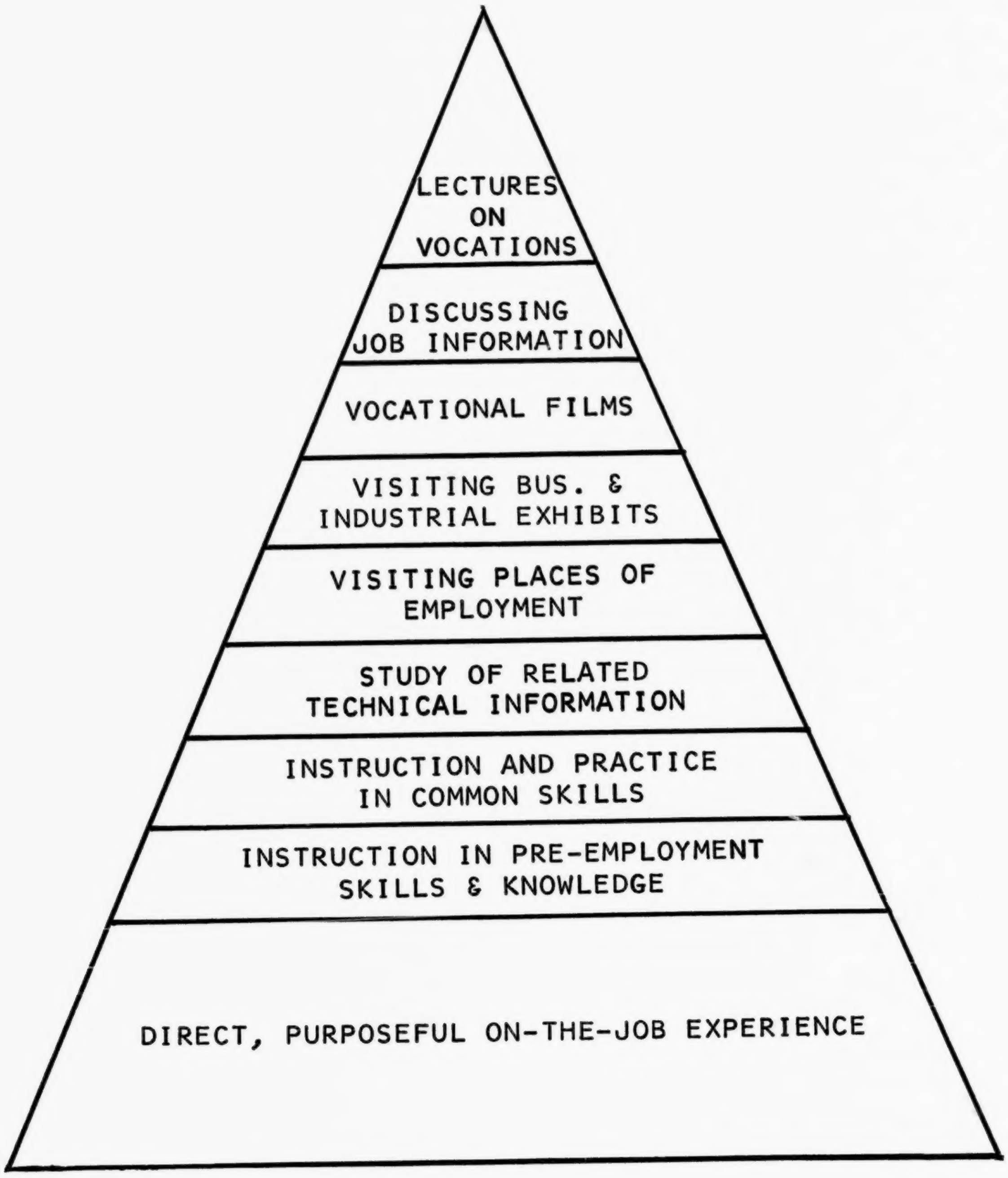
THE "CONE OF EXPERIENCE"


VERBAL SYMBOLS
VISUAL SYMBOLS
RECORDINGS·RADIO STILL PICTURES
MOTION PICTURES
TELEVISION
EXHIBITS
FIELD TRIPS
DEMONSTRATIONS
DRAMATIZED EXPERIENCES
CONTRIVED EXPERIENCES
DIRECT, PURPOSEFUL EXPERIENCES

COPIED FROM EDGAR DALE'S A-V MATERIALS IN TEACHING (DRYDEN, 1954), P. 43.

Dr. Fairchild Carter, Associate Director of Distributive Education, Indiana University, adapted Dale's Cone of Experience for the vocational field as follows:

VOCATIONAL EXPERIENCES


LECTURES ON VOCATIONS
DISCUSSING JOB INFORMATION
VOCATIONAL FILMS
VISITING BUS. & INDUSTRIAL EXHIBITS
VISITING PLACES OF EMPLOYMENT
STUDY OF RELATED TECHNICAL INFORMATION
INSTRUCTION AND PRACTICE IN COMMON SKILLS
INSTRUCTION IN PRE-EMPLOYMENT SKILLS & KNOWLEDGE
DIRECT, PURPOSEFUL ON-THE-JOB EXPERIENCE

It may be observed from the foregoing that the learning resource center could encompass or could at least be involved in all the learning experiences provided by the institution of which the learning resource center is an integral part.

Moldstad and Faris in their study of instructional and learning resource centers identified eight broad functions which they found in varying degrees among the centers.

1. Provide professional assistance to teachers and administrators in the programming of instructional materials for classroom and related uses.
2. Provide professional assistance in preparation of local materials.
3. Provide professional assistance in facilitating the transmission of educational information (includes transmission by whatever form or channel--films, television, radio, live demonstrations, etc.)
4. Provide for in-service education in the selection, use, preparation and evaluation of instructional materials.
5. Provide leadership by demonstrating new practices and trying out new ideas.
6. Provide supervised work experiences for students in the areas covered in the 5 functions outlined above. (Such work experiences may motivate students to pursue related vocational or professional careers.)
7. Assist research teams in conducting studies involving instructional materials.
8. Assist in the professional preparation of IMC specialists in cooperation with institutions of higher learning.

In this study Moldstad and Faris include a carefully prepared list of specific activities for each of the foregoing eight broad major functions.[2]

Numerous other writers have called attention to the various functions and the growing importance of the learning resource center. There are a number of reasons for this attention to learning resource centers. Among these are:

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[2] John Moldstad and Gene Faris, A Study of Functions: Instructional Materials Centers, Educational Resources and Techniques, (February 1963), pp. 3-5, 22.

1. The increasing variety of resources becoming available with a growing need for some agency to specialize in this area. To the long list of technological instructional resources which were available 15 years ago have been added television, electronic learning laboratories, video tape recorders, computer assisted instruction, dial access, etc.

2. The knowledge explosion with its accompanying problems of selection, storage and retrieval of information.

3. The population explosion with a need for efficiently supplying and utilizing the learning resources for educating all our people.

4. Dropouts from formal schooling with the need for a learning environment that will help each individual develop his potential.

5. The battle for the minds of men in a world of conflicting values--sparked by Sputnik a decade ago and by the USSR's continued attention to educational technology.

6. Changing emphases in education with a need for learning resources which are responsive to these changes.

It is with the last mentioned item--the changing emphases in education and examples of corresponding attention to learning resources that the major portion of the remainder of this paper will be concerned. Some will be touched upon briefly and others at greater length. Some of the changing emphases were adopted from among those postulated by Harold B. Gores in an address at the 43rd Annual Convention of the State School Board Association in December, 1962.[3]

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[3] Schools for the Sixties, a Report of the NEA Project on Instruction, Ole Sands, Director, NEA, (McGraw-Hill, 1963), p. 117.

CHANGING EMPHASIS #1.

From		To
The group, primarily	⇨	Both the group and the individual

Although there has always been emphasis upon learning as an individual process, major attention has been given in the past to instruction in classroom size groups. Buildings were designed for this arrangement. Learning resources such as motion pictures, filmstrips, tape recorders and the opaque projector were designed for group use with the instructor presenting the materials. With the changing emphasis to the individual, however, significant changes have come about in the design of equipment and locations for its use. Smaller filmstrip viewers for individual use in the learning resource center, in classroom carrels, and at the individual's desk are now possible and in fact are used this way profusely.

The tape recorder which was originally designed for group use is now being used routinely for individual listening to prepared recordings in every subject area and for recording the students' voices for various purposes.

The 8mm motion picture projector with its compactness and ease of handling has brought motion pictures to individuals in school and industry alike. The so-called single concept or single topic film of 30 seconds to five-minute duration in cartridge form has ushered in a new era for individual learning from motion pictures. It is interesting to note that the 35mm film brought motion pictures to the school, the 16mm to the classroom and the 8mm to the individual--for whom it was originally designed as a peephole apparatus by Thomas Edison.

An example of the high degree of attention which is being given to the individual can be seen in Don Bushnell's CLASS experiment at the Rand Corporation in Santa Monica. Each student's desk is equipped with a modified microfilm projector which presents stimulus materials, a programmed frame at a time to the learner. A second item of equipment enables the student to respond and receive immediate feedback regarding his response.

Teaching machines, programmed texts, computer assisted instruction, and dial access are all examples of the attention being given to the individual. At Beverly Hills, California, eight closed-circuit video channels have been installed and connected to eight video tape recorders. Students in learning carrels dial for the programs that are assigned for their study.

In Vallecito, California, individual students interact with a computer in a course in critical thinking involving

American history. A slide projector presents the stimulus material through a rear projection screen to the student who is seated before a typewriter in a carrel. He types his response on an electric typewriter which is connected to a computer. The computer in turn responds to the student by means of the typewriter. If the student continues to give the wrong response the computer advises him to see his instructor.

Of the many additional examples of computer assisted instruction for the individual, Suppes' laboratory near Stanford University in California is one of the most interesting. Here in a single room 16 children can be studying at their own pace with the aid of computers. The programs in reading and mathematics are for very young children who spend about 20 minutes at the computer. Stimulus materials often in the form of a picture from a filmstrip are presented on a screen. Earphones carry an audio message and also feedback from the computer. An electric pointer which the student manipulates against the television screen enables the student to respond to directions. The computers not only program individually for each learner but also keep a complete record of his learning.

The emphasis upon the individual has not detracted from continuing attention to group instruction. Phono-discs, tape recordings, filmstrips and numerous additional media available for individual use are employed for group instruction. The overhead projector is a relatively recent development for group instruction. Many institutions have followed the example of the University of Wisconsin with their large screen projection for classes of 300 or more students. Behind the 9 ft. x 14 ft. rear projection screen is a battery of equipment including 2 x 2 slides, a motion picture projector, an overhead projector, an opaque projector, a tape recorder, etc. Material from the various projectors is programmed for as many as three images at a time on the three sections of the screen. The entire 40-minute presentation is automatically programmed so that the right material is presented at exactly the right time.

Another example of the attention to large group instruction is instructional television which can reach a larger audience immediately with synchronized sight and sound than can be accomplished in any other way.

A device which incorporated attention to both the group and the individual can be seen in the EDEX system where information is presented to a large group of students responding individually during the presentation. The instructor can know at any moment which students are having difficulty and can modify his presentation accordingly.

CHANGING EMPHASIS #2

From		To
Memorization	⇨	Inquiry

There is growing realization that students often need to proceed through the thinking process instead of being constantly provided with the product of logical thinking. Consequently materials from the learning resource center are taking on a new design. Instead of being straight exposition and providing answers they are becoming stimulus materials for the students to form hypotheses and then devise ways to test their hypotheses. Dr. Robert Suchman and others have prepared films which are only two or three minutes in length. These present a phenomenon which seems to contradict what the student already knows. With the teacher as a guide, the students postulate hypotheses which become a basis for a search for relevant information. In his search for information and ways to test his theory, the individual student often needs to consult several types of media provided by the learning resource center. This shift in emphasis from memorization to inquiry--the thinking process--does not minimize the need for memory but places it in a different context than one of mere recall.

CHANGING EMPHASIS #3 AND #4

From		To
The graded school	⇨	Flexible or non-graded school
The teacher as a general practitioner	⇨	The teacher as a member of a team

The Lewis and Clark Elementary School, Riverview Gardens School District, St. Louis, Missouri, and the Granada Community School, Corte Madera, California, are good examples of the above changing emphases. The Lewis and Clark School is snail-shaped with all rooms having access to the perception core which represents a learning resource center in the very center of the building. A learning resource specialist assists teachers in the preparation of materials for instruction.

The Granada School in California revolves completely around team teaching and the non-graded school. The equivalent of four classrooms of children are housed in a large, well-equipped, carpeted and functionally-shaped room which is divided into five generous spaces for groups of children and teachers to assemble. One of the five spaces in the center of the room functions as a learning resource center with a motion picture projector, a filmstrip projector, a listening post equipped with a tape recorder, etc. These are used freely by pupils and teachers.

CHANGING EMPHASIS #5

From		To
The self-contained classroom	⇨	The self-contained school

By shifting the emphasis from a self-contained classroom to a self-contained school a greater variety of learning resources can be made available to the individual teacher and to the students. The consolidation of purchasing power in a learning resource center makes it possible to supply materials, equipment and services which the individual classroom could not afford. While individual classrooms are becoming equipped increasingly with filmstrip and overhead projectors, few can afford their own 16mm motion picture projector with the supply of films needed, the equipment for producing transparencies and all the other types of learning resources. These can be made available for distribution, however, from a learning resource center in the school.

The resource center at Chabot Junior College in California is an excellent example of what can be done by putting all types of media to work through a learning resource center. The usual audio-visual materials and equipment are distributed as needed and, in addition, electronic distribution of tape recordings is made to listening locations throughout the center. Closed Circuit Television, videotape recorders and numerous materials and services are supplied which could hardly be provided by a self-contained classroom.

Another example of a recent change to the concept of a self-contained school can be seen at the Osborne School, Phoenix, Arizona. There the typical library was enlarged for the addition of learning carrels with audio-tapes, filmstrips, motion pictures, etc. Both students and teachers make constant use of the newer media including programmed learning materials, audio-tapes, filmstrips, sets of still pictures, motion pictures, etc. The learning resource specialist is in constant communication with the teachers in the classroom encouraging them to install learning carrels and use materials that have been found effective in the learning resource center. A decentralization of some of the materials used frequently in the classroom makes it possible to bring in and try out additional materials in the LRC which will eventually be placed semi-permanently in the individual classroom. Another feature of the center at the Osborne School is the provision for the preparation of local materials. Both students and teachers prepare transparencies and other materials for use in their classroom presentations.

CHANGING EMPHASIS #6

From		To
Rigid scheduling	⇨	Flexible scheduling with appointments and independent learning

Independent learning has been made increasingly possible through the materials made available from the learning resource center. Programed learning materials, 8mm single topic films, computer assisted instruction, dial access, filmstrips for individual viewing are all materials that emphasize the possibilities for independent study. Self-instructional carrels equipped with a variety of media are enabling students to learn an increasingly larger percentage of a course directly from the media. These services and resources free the teacher for flexible scheduling with small groups.

CHANGING EMPHASIS #7

From		To
The school plant designed for an agrarian society-- for a nine-month year, limited to children	⇨	The school plant reflecting the needs of an urban society-- for twelve-month year-- for all age groups

While some buildings of traditional design continue to be constructed, much is happening with "form following functions." The growing recognition of the role of learning resources in schools which reflect the needs of a varied urban society has literally placed the learning resource center in the center of the building often with satellite centers strategically located. The octagonal shaped buildings at the University of Miami, Coral Gables, Florida; at Appalachian State College, Boone, North Carolina, and an increasing number of other institutions make use of rear projection screens which form the partition between the learning resource center and the classrooms which surround it. Thus the projection of any material for any of the classrooms is readily accomplished.

In addition to a centrally located learning resource center, spaces for individual students and small groups of students are being designed as a basic consideration from the very beginning of building planning.

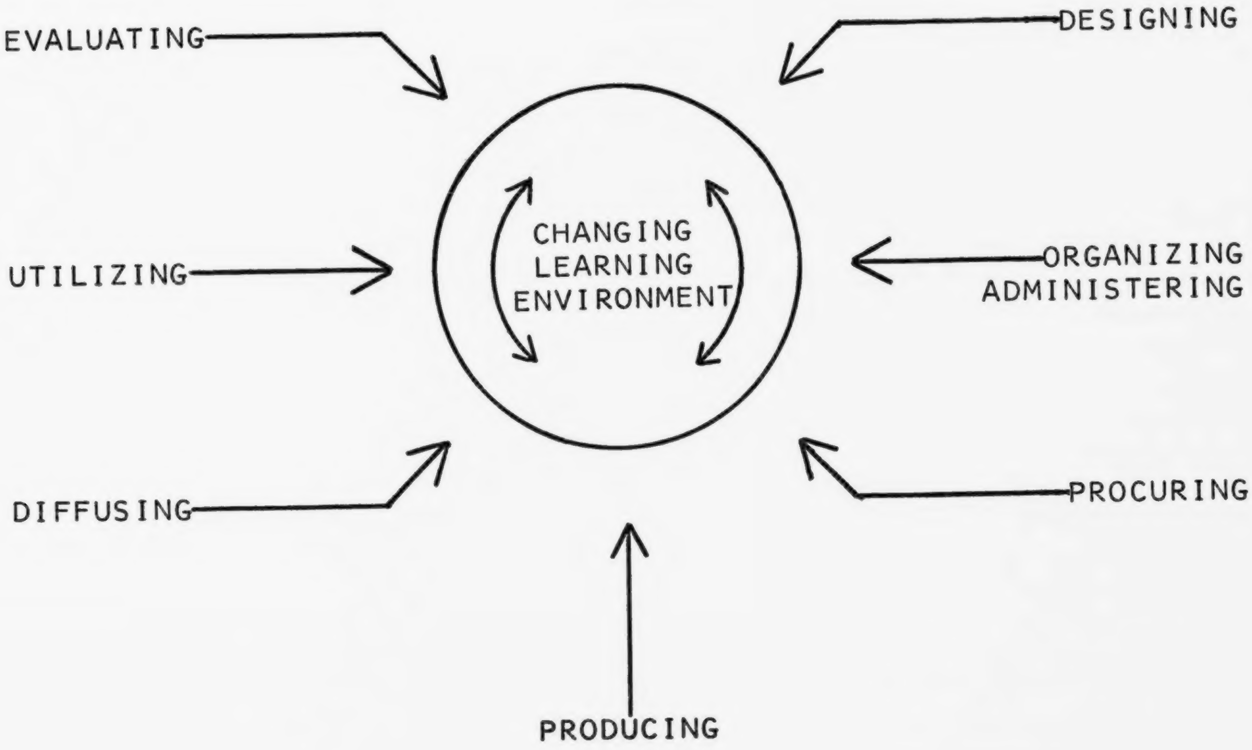
FINAL STATEMENT AND A LOOK TO THE FUTURE

(1) A recognition of the contributions which can be made by a learning resource center or an office of learning resources will continue to grow. There is an increasing realization that once methodology and content have been decided, media often become the major part of the curriculum for the individual student. Changes will occur, however, in the conceptualization of the learning resource center and its functions. Perhaps these will evolve from viewing the learning resource center from a process approach instead of being media and product centered as many learning resource centers are at present. Specific media would be important to the extent that the processes are enabled to achieve the purposes of the institution.

An outline of a process approach to the functions of the learning resource center follows:

LEARNING RESOURCES CENTER

A PROCESS APPROACH


EVALUATING
DESIGNING
UTILIZING
CHANGING LEARNING ENVIRONMENT
ORGANIZING ADMINISTERING
DIFFUSING
PROCURING
PRODUCING

The processes would appear as follows if applied to the learning resources center.

DESIGNING................*the learning environment*

ORGANIZING AND ADMINISTERING....*learning resources*

PROCURING........................*available media*

PRODUCING...........*media not otherwise available*

DIFFUSING.............*media and ideas relevant to instructional procedures*

UTILIZING......*media and instructional procedures*

EVALUATING.............*effect of media on learner*

RE-CYCLE.......*re-design the learning environment*

(2) The number and types of personnel in the LRC will need to be greatly expanded beyond anything we may conceptualize at present although increased use of technology could reduce somewhat the total number needed. The need for specialized skills and competencies within the LRC will continue to grow. Competencies in systems design and in message design are needed in addition to the usual specialized skills presently found in the LRC. Line and staff-organization for personnel functions may become quite strained in order to accommodate all the types of specialists needed. Data processing and computer experts, for example, may well come in for periods of time and be attached directly to the top ranking official in the institution instead of being responsible only to the head of the LRC.

(3) Change in the design of media content will parallel the changing emphases in education. It may be a moot question, however, as to whether the change in emphases in education results in a change in learning resources or vice versa. There is a probability that the advent of individual filmstrip viewers and 8mm motion pictures for example focused upon the suitability of these materials for individual learning. Other technological developments such as dial access, teaching machines and computers could easily have become the stimulus for other changing emphases in education. Perhaps the following unheralded and largely unnoticed changes in learning resources have served as a progenitor for subsequently discovered changing emphases in education:

From		To
Audio-visual materials as an AID to the instructor	⇨	Educational media as resources for the learner
Audio-visual as additive or supplementary	⇨	Media as basic instructional resources
Audio-visual materials as isolated piecemeal productions	⇨	Integrated, systematized media and procedures
The need for an audio-visual specialist as an implementer	⇨	The need for many types of specialists, especially as members of teams to design and evaluate learn-experiences.
Classroom arrangement	⇨	Learning laboratory arrangement replete with media, equipment and specialized personnel

Learning resources, including the professional services of personnel, are finding their way to the places where learning can most efficiently take place. This will not always be at the LRC. This is especially true in industry where a desired change in skill accompanies a desired change in information and attitude. Dave Hennessy, Supervisor of Training Communications and Programming at the Cummins Engine Company, Columbus, Indiana, has found that adequate training can be achieved most efficiently by providing the learning resources at the trainees usual working location. A systems analysis of training requirements by Mr. Hennessy and his associates resulted in a comprehensive training package including motion pictures, diagrams, worksheets, guides and other integrated materials including sound filmstrips. Some of the sound filmstrips must be used by the trainee as he works on the actual equipment at the usual bench or job location. This procedure of moving the learning resources out of the center to the learner will be increasingly important in vocational and technical education.

(4) The concept of a center which houses, maintains and distributes all media and controls all distribution is obsolete and has not really operated for some time. There will continue to be increasing decentralization of resources to satellite locations and to classrooms where the equipment and materials are needed permanently. Carrels and listening booths and overhead projectors are not being circulated from a center but are permanent learning requirements of both the center and the classroom. The center will continue as a place where new materials are brought in for trial and experimentation. The concept of a center to which all students come for retrieval of information--message material if you will--will be increasingly complemented by moving the information to the student. The very logistics of the problem with the vast geometric increase of information and the traffic of live bodies make it imperative that information be moved as efficiently and rapidly as possible to the learner and to the instructor wherever they may be. This means increasing use of data processing, of computers or whatever encoding and decoding devices and electronic marvels become available.

(5) There are numerous conceptualizations for the LRC--for the individual school, for the school system, for the state, for industry and for government. There are LRC's to which the students come, others to which teachers come and some to which both students and teachers come. These centers to which students and teachers travel will continue to exist and to make their contributions. Thus it is evident changes have occurred. It is to be expected further changes will emerge. It seems reasonable to conclude, however, that the learning resource centers which will make the maximum contribution are those who will venture forth to the learner wherever he may be and will provide a learning environment that will most effectively help him reach levels of performance required in a highly developed technological society.

THE LEARNING RESOURCE CENTER

Interest Group Session

George Vanover,[1] Chairman
Mendel Sherman,[2] Consultant

The interest group session was an outgrowth of the consultant's presentation, "The Learning Resource Center and Changing Emphases in Education."

The learning resource center consists of a facility where all types of media for learning and instruction are obtainable and used, and where materials and human resources are available for the development and production of instructional materials.

Dr. Sherman described some of the problems of developing and operating a learning resources center and made the following recommendations:

1. Each institution should centralize the purchase of media and keep control of its use and location by continuous inventory. A system should be established by the Director of the Materials Center so that he knows the whereabouts of every piece of equipment at all times.
2. Programs need to be developed at the collegiate level to prepare persons to design and operate a Learning center. (The consultant had 170 contacts for qualified persons with only 12 graduates to fill the positions.)
3. Curriculum must be designed so that students understand how people learn, know media and its characteristics, and understand the strategies of instruction.

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[1] Mr. Vanover is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Dr. Sherman is assistant director, Audio Visual Center, Indiana University.

4. To be most effective, media must be used at the appropriate time and incorporated with a learning objective.

5. Users must be sure the selected media will do what they want it to do before using it.

6. Users should apply a systems approach and should build curriculum and media together. Media may be effectively used to develop inquiry.

7. Instructional learning centers should be built in the center of an instructional area so that it can be readily accessible for use by the learner.

B. MEDIA FOR INDIVIDUALIZED INSTRUCTION

THE USE OF MULTI-MEDIA IN SCIENCE EDUCATION

Samuel N. Postlethwait[1]

The current trend in education is to incorporate more and more of the subject matter into some kinds of new communication media. It is the practice of many investigators to decide upon a single medium and attempt to use that medium to communicate all facets of a given subject. In some instances the situation is made even more complex by using conventional course structuring. The consequence of this approach is to severly limit the exploitation of the unique communication features of the medium and to shortchange important aspects of the subject matter itself.

The reason for this approach all too often is the lack of an open-minded definition of the problem. Most of us, teachers, students, parents, and administrators, are steeped in a tradition of lectures, classrooms, and schedules which we have come to accept as the "educational process," and we find it very difficult to investigate a new approach in an unbiased way. Simple observations reveal the process of learning taking place at a rapid rate and with extreme effectiveness outside the formal structuring of school systems. Children and adults learn trivial and useless statistics related to casual entertainment and commonplace activities. Names, dates, and places associated with our favorite comedian, sports hero, or vacation spots, pose very few problems in memorizing and understanding for even the least scholastically oriented person. TV and radio commercials, road signs, and newspapers are adequate teachers of this subject matter.

If the above can be accepted as a partially accurate representation of existing conditions, one can collect some data from which it is possible to formulate some useful guidelines for adoption of media. The following ideas, even though they are not new, include the author's views.

1. Learning must be done by the learner. This simple truth suggests that any learning situation that is structured will be at maximum effectiveness only when there is total involvement by the learner himself. While some learning does take place vicariously through lectures and other situations

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[1] Dr. Postlethwait is professor of botany, School of Science, Purdue University.

where the learner is passive, it goes without saying that if one wants to maximize learning, it is necessary to structure some other sort of vehicle.

2. A good learning situation involves an opportunity for the student to repeat any or all of a learning unit. However, control of the repetition should reside with the learner so that the repetition can be commensurate with the individual needs. Unnecessary repetition is a waste of time and becomes a source of severe frustration to capable students. It often results in loss of motivation and produces negative results. On the other hand, the opportunity to repeat small units involving critical information can provide successful learning experiences for students who might otherwise flounder in the flood of subject matter presentation. No human being can make sound judgments as to how much repetition is necessary for someone else. Since people are so variable, even when those persons have been somewhat selected (i.e. those enrolled in a freshman botany course), it is necessary that the course structuring permit the learner to exercise his own judgment as to the need for repetition.

3. Association with a real or simulated item or event enhances learning and retention. Inasmuch as it is feasible, one should never replace the real item with photographed charts or diagrams but should use all audio-visual aids to focus attention on and develop understanding of the real subject. In a course in plant science, this suggests the best learning situations would be those in which students were examining, handling and experimenting with real live plants.

4. A good learning situation would minimize distracting factors. Most classrooms are not organized to permit the students to concentrate during their study. A well-structured learning system should provide the student an opportunity to isolate himself from the surrounding environment for those kinds of individual exercises which are best accomplished in isolation. However, it is important to provide variation and an opportunity for direct personal contact between teachers and other students.

5. The size of the subject matter units should be adjustable by the student. People vary in the amount of subject matter that can be grasped in a given amount of time. It has been well demonstrated by programmers that most people can learn almost anything if it is broken into appropriate size units and if they can proceed at their own pace. Many students who are perfectly educable may be either overwhelmed or frustrated by large-step systems which are not in phase with their optimum learning rate. An educational system which is essentially a "deliver-on-an-assembly-line belt" may be much too slow for the students with a high capacity but may be

much too fast for others who, for some reason, have poor background or are poorly conditioned to receive this subject matter. Any program of study should provide each student an opportunity to adjust the size of the unit to his own ability to assimilate the information. By these means, those who can absorb large quantities of information may do so in an unrestricted fashion, whereas those who must proceed more slowly are permitted to do so. When the potential for these adjustments are not available, students develop barriers to learning which are difficult to overcome in later life. Furthermore, students who are forced to move ahead, when they have established a poor foundation on which to build new information, may become depressed and lose much of the motivation which develops from a successful experience with learning.

6. The communication vehicle should be adapted to the nature of the objective. For a complex subject such as botany, it is obvious that no simple vehicle such as lecture or a textbook can adequately expose the students to all the necessary experiences. The many new communication vehicles available provide convenient and unique ways of exposing students to subject matter. In cases where the development of a procedural skill is necessary, there is no substitute for the student doing this procedure himself. Therefore, a properly structured course should have carefully defined objectives and should not attempt to mold the objective to fit a favorite medium such as lecture. Instead the course should use the medium best adapted to the objective itself.

7. A well structured course should provide a multiplicity of approaches. Individuals differ in their responsiveness to different kinds of communication devices. Some people learn best through auditory communication, some through reading, and others through handling specimens and performing experiments. A student should have an opportunity to approach an objective in a great variety of ways, exploiting the medium which communicates most directly and effectively for him.

8. A well structured course should provide an opportunity to integrate the learning activities. The conventional structure of lecture, recitation and laboratory may expose a student on Monday to a lecture, Wednesday to experimentation, on Friday to recitation, and on Sunday night to reading the text. These dissassociated experiences do not permit the complementary effect that can be achieved when these experiences are brought into close proximity and are properly sequenced. One might compare this analogously to an orchestra. Many musical instruments making sounds in a random fashion result in noise or cacophony; however, these same sounds, if timed and placed in an appropriate sequence or relationship to one another, form a melody. This is not to say that review or recall is of no consequence in learning, but rather to say that an initial thorough understanding will

provide a better basis for later review and reinforcement.

Because education is a science, one must define the problem first and then go about logically developing a procedure which permits the student to engage in those activities which result in learning. This may require a total restructure of courses and reorganization of approaches. The Audio-Tutorial System developed at Purdue University for a freshman botany course is an attempt to do this. During the past six years the course has undergone several major changes. Currently it is structured with two scheduled class meetings per week. The remainder of student study is accomplished independently in a laboratory adapted as a Learning Center.

The Independent Study Session (ISS) is at the convenience of the student between the hours of 7:30 AM and 10:30 PM, Monday through Friday. On arrival at the Learning Center, the student signs in on a card which he places in a numbered slot, assigning himself to a specific study booth. Each booth is equipped with a tape player, an 8mm movie projector, and other materials appropriate to the week's work. The student begins his study by listening to the senior instructor on tape and is then tutored through a sequence of learning events. The student prepares himself for the study by having available a set of objectives for the week's work, his textbook, a study guide, and a set of study problems. The senior instructor, in a conversational tone, programs the student through a variety of activities including experimentation, reading from the text, examining specimens, manipulating the microscope, viewing short film clips, or any other kind of activity appropriate to the nature of the subject matter and the objectives. The tape can be stopped as often as necessary for repetition or to provide the student an opportunity to collect data, set up an experiment, or to perform some other procedure. After the tape plays, the senior instructor can ask leading questions or can assist with an analysis and reinforcement of the preceding learning activity. Reel to reel type 8mm film projectors with variable speeds forward and backward as well as a hold are used to permit students the same potential for studying the film as for taped listening. The author has experienced very little difficulty in student operation of this equipment and is convinced that this kind of equipment provides an additional dimension to the utility of 8mm film beyond that of the cartridge loaded machines.

The two basic devices--the tape recorder and an 8mm movie projector--coupled with other appropriate materials permit the integration of every kind of learning experience necessary in a course such as botany. Further automation or coupling of these devices nullify the principle that learning must involve the learner, and the author feels strongly that any device which is automatically regulated tends to parade subject matter before the student with little or no impact.

There are some other kinds of learning experiences which can best be executed in large groups and in small groups. To accommodate this, all students in the course are scheduled one hour each week to a General Assembly Session (GAS). These sessions are under the direction of the senior professor but are merely help sessions, except on special occasions. No attendance is required; however, students are encouraged to attend special sessions involving the presentation of long films, guest lecturers, and tele-lectures, as well as some orientation sessions. The week's study terminates in a Small Assembly Session (SAS) involving eight students and an instructor. This session has been called an Integrated Quiz Session (IQS) to convey some impression of its seminar nature. The instructor has available the various items which were included in the laboratory the preceding week and which were used to assist the student in achieving the week's objectives. The items which may include plant specimens, portions of experimental equipment, graphs, diagrams, movies, microscope slides or any other appropriate item, are presented to the student in a programmed fashion. The student to receive an item is selected at random, and he is expected to respond in a specified format. The student identifies the item, relates it to the appropriate objective, and then proceeds to show his mastery of that objective. Each student is graded immediately by being placed subjectively into one of three categories. If the instructor is much impressed, the student is placed in a category of excellent and given a 9. If the instructor is not very much impressed, the student is placed in the category of mediocre and given a 7. If the instructor feels depressed, the student is placed in the category of poor and given a 5 or less. After each student has completed his presentation, other students may enhance their grades by making further contribution and/or corrections. This oral quizzing has been a useful tool for structuring the students' approach to their study and has been a good source of feedback to help improve the study programs. This session is designed to employ the principle that "one really learns a subject when he begins to teach it." Therefore all six hundred students enrolled in the freshman botany course at Purdue become teachers and prepare a little lecture about each of the items included in the laboratory.

Thus far the results of this program have been positive from every point of view. The response of students has been overwhelmingly positive with 96 percent reacting favorably to the system. Grades have improved in all categories, and subject matter content has been increased an estimated 50 percent. The only limitation to the system seems to be the imagination and skill for developing effective soft-ware.

THE AUDIO-TUTORIAL SYSTEM

Interest Group Sessions

James L. Hoerner,[1] Chairman
and Marla Peterson,[2] Chairman
Samuel Postlethwait,[3] Consultant

Dr. Postlethwait reacted to the following questions from the participants. The respective groups then discussed applications of the system to vocational and technical education.

Question: Do you have some students who finish the course at a different time than other students?

Answer: No, students are generally locked to a weekly schedule because of the nature of the subject. However, they would not need to be for many other subjects.

Question: How do you set up to make the tapes, and are students available at the taping?

Answer: No, but it would be a good idea to have a student there. All I do is sit down and talk about the subject as I would to any one student in the class. Instructions must be very precise to assure that the student understands.

Question: What are the implications for structures, buildings and classroom arrangements?

Answer: Special arrangements are desirable. It would be somewhat beneficial to have listening booths with activity centers. Colorado Mountain College at Glenwood Springs, Colorado, a new community college, is specially designed for this type of instruction. All learning takes place in the centers.

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[1] Mr. Hoerner is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mrs. Peterson is activities coordinator, Business & Office Occupations, The Center for Vocational and Technical Education, The Ohio State University.

[3] Dr. Postlethwait is professor of botany, School of Science, Purdue University.

Question: How do you provide for updating the tapes?
Answer: I erase them all and start over each year.

Question: Do you keep a notebook or something to cue you in on needed changes?
Answer: I keep a card file; besides, we have continuous feedback from students.

Question: How do the students like you wandering about them while they are studying?
Answer: Many of us are scared to death that they are going to learn without us, and so am I.

Question: Can students from other curriculums come to the center for just a few lessons or any part of the course that they would like?
Answer: This could be arranged if the total course were arranged into precise units. Then anyone could take the units in which they were interested.

Advantages of the System

1. Students have the opportunity to pace their learning according to their own ability.
2. Because of the necessary preciseness, the instructor will better prepare his presentations.
3. Students are more involved during the activity.
4. Because students are able to finish a unit of study at various times, some have time to study in a related area.
5. Students do all their learning in the study laboratory center.
6. Students outside of the botany curriculum can take that portion of the botany course which they desire.

Disadvantages of the System

1. The system must be very well programmed so that everything will be covered.
2. Scheduling becomes very important to prevent bunching of students at various stages of the material and on the equipment.
3. Updating each year is a big job.

Suggested Applications of the System

No specific best applications were discussed by service areas. However, it was mentioned that some subject matter lends itself to this approach better than others. Some participants felt that concrete-type content would be of this nature.

It was pointed out that The Ohio State University is using this approach in a basic survey course in teacher education. The University of Connecticut is also using this audio-tutorial approach to teach an audio-visual course.

There was some discussion as to the best strategy for developing and applying this medium in vocational and technical education. It was suggested that the complete system approach would be better for switching to Dr. Postlethwait's method of instruction, perhaps in the manner that the Colorado Mountain College is doing.

Some participants however, felt that a slow start and gradual change to a systems approach would be one way of implementing change.

The audio-tutorial system, as a highly programmed approach to learning, requires much planning. Therefore, it was suggested that caution be used in such planning to maintain a good program.

It was also mentioned that the teacher's objectives should be written in educational outcomes which perhaps would help lead to this new medium approach. Oakland Community College in Michigan was suggested as a college that lists its course objectives in this manner.

Facility Implications of the System

The audio-tutorial system does require some different facility arrangements. There must be some kind of individual study booths grouped about a large activity lab center.

Dr. Postlethwait described several arrangements that might be functional. Most standard classrooms could be converted to such use.

DATA STORAGE AND RETRIEVAL

Interest Group Session

Paul H. Steagall, Jr.,[1] Chairman
J. C. DeGraaf,[2] Consultant

The consultant in this session explained the Bell and Howell Microfilm System. He then stimulated a discussion of microfilm versus microfiche and of the use of microfiche by ERIC.

Advantages of Microfiche

1. Microfiche is a French word which means microcard. Microfiche is a 4" x 6" sheet of film.
2. One microfiche card holds up to 60 pages of text.
3. A single microfiche card used by ERIC costs only nine cents.
4. Microfiche has most of the advantages as listed for microfilm.

Advantages of Microfilm

1. Space saving--contents of 50 file cabinets on microfilm can be put in one desk drawer.
2. Time saving--computer printout can be filmed just as it comes from the computer at the rate of 5000 lines per minute.
3. Inexpensive--letters and records can be put on microfilm for just one-tenth of a cent each.

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[1] Mr. Steagall is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. DeGraaf is a representative, Bell & Howell Co., Micro-Data Division, Chicago, Illinois.

4. Film can be read on a big 14" x 14" screen--television size.

5. Microfilm can be converted to a permanent, full-size 8 1/2" x 11" paper copy.

Disadvantages of the System

Special equipment is needed--a reader priced from $150 and a reader-printer for microfiche if paper copies are needed.

Value of the System

It can be used in keeping student records, school accounting records, and teacher retirement records.

It provides for an expansion of library materials in all areas.

It aids in the dissemination of information.

ERIC

The U. S. Office of Education has established a nation-wide information service to put the results of new educational research into the hands of those who need it at nominal cost to the user. This service is called ERIC. ERIC stands for Educational Resources Information Center and consists of a headquarters office (Central ERIC) and a network of 18 clearinghouses. Abstracts of all documents acquired by the 18 clearinghouses are published in a monthly bulletin. (See list below.)

An ERIC Document Reproduction Service (EDRS) operated under an Office of Education contract with Bell and Howell Company in Cleveland, Ohio, provides reproductions of all reports cited in Research in Education, a U. S. Office of Education, Bureau of Research, monthly publication.

EDRS sells microfiche cards (a single card costs nine cents and holds 60 pages of a report) and hard copy of the reports collected by ERIC. Copies of reports must be ordered by their ED numbers, which are provided, along with prices, in Research in Education.

ERIC Clearinghouses

Library for Adult and Continuing Education, Syracuse University

ERIC Clearinghouse on Junior Colleges, University of California at Los Angeles

ERIC Clearinghouse on Counseling and Personnel Services, University of Michigan

ERIC Clearinghouse for Early Childhood Education, University of Illinois

ERIC Clearinghouse on the Disadvantaged, Yeshiva University

ERIC Clearinghouse for Educational Media and Technology, Stanford University

ERIC Clearinghouse on Educational Facilities, University of Wisconsin

ERIC Clearinghouse on Exceptional Children, Council for Exceptional Children, Washington, D. C.

ERIC Clearinghouse on Science Education, The Ohio State University

ERIC Clearinghouse on Teaching of Foreign Languages, Modern Language Association of America, New York City, New York

ERIC Clearinghouse for Library and Information Science, University of Minnesota

ERIC Clearinghouse on Linguistics and Commonly Taught Foreign Languages, Center for Applied Linguistics, Washington, D. C.

ERIC Clearinghouse on Reading, Indiana University

ERIC Clearinghouse on Rural Education in Small Schools, New Mexico State University

ERIC Clearinghouse on School Personnel, City University of New York

ERIC Clearinghouse on Educational Administration, University of Oregon

ERIC Clearinghouse for the Teaching of English, National Council of Teachers of English

ERIC Clearinghouse on Vocational and Technical Education, Ohio State University (This includes Industrial Arts)

WRITING FOR PROGRAMMED INSTRUCTION

Interest Group Session

Cecil Johnson and
Patricia Smith,[1] Chairmen
Leonard Strodtbeck,[2] Consultant

In this session, the consultant defined programmed instruction, described a program writing format, and summarized programming rules.

Programmed instruction is a means used to accomplish specific objectives. This type of instruction may be produced in various forms such as books, audio and video tape, TV, random access, and computer programming. The goal of programmed instruction is to keep the mind active and cue the participant to response.

Programmed instruction is material presented in a series of frames leading up through impression to idea to concept stage. Good programmed instruction pulls concepts out by controlling input and feedback. Excessive verbage is stripped and content is compressed into a tight package. Approximately 92 percent of all frames should call for a response on the part of the student. Good programming follows a definite format. First a definite objective is formulated, information leading up to the objective is provided, the student is asked a question, provided with the answer, and if the answer is correct, reinforcement is provided. If the answer is not correct, the student is redirected to preceding information.

Programmed instruction forces planning through organization of content in a logical, understandable sequence. As content is compressed, the individual student is moved through the materials at a rate compatible with the student's ability. Teacher time is saved because the teacher need provide time for the individual only when he is unable to proceed further through the programmed material.

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[1] Mr. Johnson and Miss Smith are research associates, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Strodtbeck is a program writer, Electronic Products Corporation, Cleveland, Ohio.

The procedure for writing programmed instruction should include the following:

1. List the objectives in behavioral terms after consultation with the media specialist, the artist, and a subject matter specialist.
2. Prepare an outline to be checked by the resource people.
3. The first draft frames, verbage plus picture, are then developed. These are edited by a specialist for errors in communication, by a technical expert, and by a skilled writer.
4. This program is then trial tested, evaluated and revised. The essential element in programmed instruction is that the environment is controlled. It imparts information; it does not test for it.

In summary, the programming rules are:

1. Require an active response.
2. Give proper cueing.
3. Give appropriate context.
4. Allow one new fact per frame.
5. Use careful sequencing.
6. Use frequent repetition.
7. Impart knowledge of subject.
8. Evoke relevant responses.
9. Do not assume background knowledge on part of audience.
10. Concentrate on teaching, not lecturing.

Problems encountered in the use of programmed instruction include identifying those students who can benefit most from programmed materials, identifying the skill or the concept to be taught, securing programmed material which will effectively teach the skill or the concept, preparing teachers to use programmed materials effectively and efficiently, and selecting reliable programs from the wealth of programs commercially available.

ON NARROWING THE CREDIBILITY GAP FOR COMPUTER-ASSISTED INSTRUCTION

Harold E. Mitzel[1]

We have been hearing a great deal about "credibility" on the political scene these last few months, so I have taken it as my theme for today's discussion. First, let us begin with the candid premise that computer-assisted instruction (or CAI) lacks credibility, in the minds of an overwhelming majority of educators, as a feasible operational tool. I know that this unbelievability for CAI is characteristic of my colleagues in the elementary and secondary schools and, to a large extent, in colleges and universities. I assume that it is also a predominant attitude among your colleagues. My regret is that I have not had more experience in the general area of industrial training so that I could tailor my remarks to your situation. Failing that, I hope that you will bear with me if I talk about possible ways of narrowing the credibility gap for CAI in the public lower schools.

There are currently a host of ways in which modern digital computers can be used to facilitate instruction or training. All of these uses can be called computer-assisted instruction in a generic sense, but I would feel on firmer ground if we could review briefly some distinctions within CAI. I think that these distinctions are best understood in relation to the function of the computer in executing a variety of educational activities.

First, a computer's remote typewriter terminal may be located in a classroom and used as a laboratory computing device, or scientific calculation aide. This use has been exploited in several high schools in the Boston area, with tele-typewriters connected by wire to a computer facility located at Bolt, Beranek and Newman, Inc., a defense contracting agency at Cambridge. Staff members from this project have reported quantum jumps in the motivation of high school pupils who vie with one another to "play with" the computer terminal. At Altoona High School in Pennsylvania, a similar use for remote tele-typewriters in the teaching of computer programming and in mathematical computing has been developed.

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[1] Dr. Mitzel is assistant dean for research, College of Education, and co-investigator of computer-assisted instruction at The Pennsylvania State University.

A second CAI definition involves the use of the computer as a record keeper and retriever of students' biographical and achievement data. This use involves batch processing of data cards by staff members instead of use of the remote on-line terminal by the learner which is essential to a rapid-fire interactive process. In a sense, a high school or college which does its course and room scheduling, or stores and prints its test results for the guidance department on a computer, is engaged in computer-assisted instruction. This application is becoming more and more common as the availability of large computers increases, estimated by the President's Science Advisory Committee to be 2500 in number in the country by 1970. Major colleges and universities and large progressive high schools currently employ this application routinely, frequently buying computer time from industry or another educational system.

Third, CAI can be defined in terms of simulation problems with the computer responding adaptively to learner input. Swets and Feurzeig, in an article in Science, have described an interesting medical diagnosis sequence involving an "on-line" interaction between the computer and the medical school trainee. At the University of Illinois Medical School in Chicago, a patient management exercise has been developed which provides a learner with an intriguing set of simulated word situations. Some "inquiry"-oriented materials have been prepared by Suchman and others for the University of Illinois PLATO system. At Penn State, Igo is preparing a simulated physics laboratory sequence for students in technical education programs. And, at IBM's Yorktown Heights facility, models illustrating physical and chemical laws have been stored in a computer. The student manipulates the several variables of a model at the computer terminal in a few minutes to see the effects of one variable on the other instead of manipulating complex laboratory equipment over a long period of time. These and other efforts underway in a variety of locations suggest a bright future for this type of computer application which I will refer to collectively as "inquiry methodology." These open-ended, problem-solving approaches seem to me to be particularly well adapted to the education of the gifted in our schools and colleges. If it were desirable to do so, the "credit-by-examination" procedure could be considerably enhanced and expanded by the use of CAI in inquiry mode, which allows learners to proceed at a pace which suits their learning style.

Fourth, CAI can be defined as a procedure whereby the computer, through its terminal or student interface, serves as a kind of "homework monitor" or "recitation receiver." In some subjects such as mathematics or statistics, it is possible to assign a student to solve a number of problems in his "out-of-class" time. Having worked through the problems, the student then enters his answers at the computer terminal and receives not only an evaluation of his work, but diagnostic and remedial information on how to correct his responses and his problem attack.

The fifth definition of CAI involves the computer in the role of tutor. In this mode, the teacher or author stores a preplanned program of instruction in the computer's memory, anticipating as many of the student's responses as possible. By using the logic inherent in the computer's processor, it is possible for the author to provide for a wide variety of individual differences among learners. Indeed, in sophisticated tutorial programs which involve many remedial branches and frequent examination of the extent of the learner's mastery, it is likely that no two learners in a group will ever take the same path through the material. In the tutorial mode, maximum adaptation can be made to the individual differences exhibited by the learners.

I have tried to identify five,distinct definitions for computer-assisted instruction in which the computer terminal is used as a *laboratory calculating device*, as a *record keeper and retriever* of student information, as a *problem solving* or *model simulation device*, as a *homework monitor* or *recitation receiver*, or as a *tutor*. For the balance of my remarks, I'll be employing either the tutorial or the simulation definition, both of which involve a sophisticated dialogue between the student and the teacher's program stored in the computer.

Let us turn now to some of the sources of the CAI credibility gap and an examination of how this unbelievability might be lessened.

First, it is alleged that CAI is too expensive for implementation in public elementary and secondary schools. This allegation is usually accompanied by figures which show that America spends about thirty-five cents per hour per pupil in order to educate its children, and that the most realistic figures for present CAI applications of an operational nature are in the neighborhood of two to four dollars per student terminal hour. I suppose that no one here believes that automobiles ought to operate on the same hourly budgets that horse-drawn buggies do, but it might be instructive to see what are some of the implicit assumptions which usually underlie this negative reaction to CAI costs versus current average costs for traditional instruction. The thirty-five cents per hour per student figure for American education is, incidentally, about one-third the cost of a good reliable baby sitter, but more importantly, it represents an *average* of educational costs from kindergarten through twelfth grade in all curricula, in rich and poor schools. Every cost-conscious school executive knows that there is a wide variation in instruction costs just within a single school district. We know that it costs more on the average to teach chemistry than it does to teach history. In South Orange, New Jersey, the assistant superintendent tells me that it costs five dollars per hour per student to teach the homebound. In almost any modern school, it costs several dollars per hour per student to instruct the mentally and physically handicapped because of extraordinary equipment and staff requirements. I don't have reliable figures on the per pupil-hour costs for an individualized remedial reading program, but they must be very high. So it seems to me that an average per pupil-hour cost of instruction is not particularly relevant to a specific decision regarding the use of CAI because of the extreme variation in these costs among different programs of instruction.

A second implicit assumption, related to the first, is usually made in examining the feasibility of CAI for schools. This is the assumption that a computer system can by some feat of magic be made simultaneously operable in all subjects taught to all ages of children; that on some given morning early in September, a school can be converted from its present teacher-mediated program to CAI. We might call it the myth of instant CAI. A strong component of this myth is the notion that tutorial CAI can replace or supplant all instructional personnel, and that the current costs of instruction, primarily salaries, may be diverted to equipment rental or purchase.

I believe that every progressive school should first divest itself of myths and oversimplifying statistics in relation to the instructional costs of CAI. The school staff should then do an exhaustive self-study of its program in order to decide on an area of the curriculum that needs improvement. Many schools would find that they were woefully weak in foreign language instruction. Others, particularly small rural schools, would sometimes find themselves deficient in advanced mathematics and science. Impelled by the example of need, the decision, as far as costs are concerned, then becomes one of deciding whether or not a potential improvement in quality in one or two crucial subjects is worth an increase in instruction costs in order to achieve that particular goal. Thus the implementation of CAI into any school ought to be deliberately done on a limited and carefully evaluated basis. Unlike industry, public schools have not traditionally had the benefit of a research and development staff. Some schools under the impact of Title III of the Elementary and Secondary Act are moving in this direction by appointing federal funds coordinators. Staffing the schools with such people is, it seems to me, an absolute necessity if we are to cut the innovation lag and make a majority of schools reasonably modern.

A second factor which contributes to CAI's lack of credibility is the dearth of good course content material for computer-based presentation. Apart from Stanford University's reading and arithmetic material for young children, Penn State's modern mathematics course at the college level, and Irvine's introduction to computer programming, relatively little CAI course material exists with a tested history in an operational education setting. Most educators remember the teaching machine fiasco of the early sixties, where there were at one time more different types of machines than there were good programs to run on them. The implication of this experience is that no educator wants to be in the position of having to defend the presence of a warehouse full of useless equipment because there are no teaching programs or software to fit the hardware.

This portion of the credibility gap, in my opinion, can be narrowed most effectively by the organization of user's groups, the members of the group having common needs and making mutually supportive contributions to the larger goal. User's groups are commonplace among universities that employ similar computer hardware configurations for scientific computing purposes. I strongly advocate similar kinds of consortia among public schools, state education departments and higher education institutions for the development of CAI course material. Emphasis within such a framework would be placed on the compatibility of the jointly developed course material for the computer and terminal hardware possessed by the consortia members without concern about copyrights and proprietary interests. Failure on the part of education institutions to grasp the initiative in the determination of what is to be taught with the assistance of the computer will allow the choice to go by default to non-educators.

A third factor contributing to the CAI credibility gap is that educators and training specialists can't quite visualize how this new tool can be succesfully integrated into their on-going programs of instruction. This disbelief seems to me to be essentially a problem in concept development and staff education.

In-school educational television, for example, is a medium that has not been fully exploited in the public schools because its utilization has not been integrated with on-going programs of instruction. Typically, the classroom teacher turns on the set at the appointed hour and then files her nails while the children watch the tube. As soon as the program is finished, the teacher says, "Now let's see. What were we doing before we were interrupted?" The Midwest Airborne Television Instruction program sponsored in five states by the Ford Foundation provides another example of a failure to determine the importance of utilization patterns in advance of the introduction of an educational innovation. If a classroom teacher wanted to use the television presentation for teaching fourth grade arithmetic, she had to turn on the tube at ten o'clock for the fourth grade lesson, ready or not. These kinds of rigidities can sabotage the best technology. Technological innovations like ETV and CAI, which are purported to be capable of carrying a major portion of the curriculum load, should not have their utilization patterns ignored if they are to become creditable.

Perhaps the worst way to go about implementing CAI into an operational setting is to get a computer and then try to decide what to do with it. A better approach for a school or a user group is to survey its educational needs and then pick out one or two significant programs where massive improvement is needed. If CAI can provide an optimistic approach to the solution of a particular problem, then it ought to be tried and carefully evaluated. The major problem of integrating CAI into an on-going school program can, then, be solved on a limited trial basis, with maximum involvement on the part of teachers, supervisors, and administrators.

I have reviewed three factors that contribute to the CAI credibility gap: 1) the cost of instruction; 2) the shortage of good course content for CAI presentation; and 3) the lack of a detailed plan for utilizing CAI within the context of an on-going instructional program. You can, I'm sure, think of others, but I hope that I may have helped you narrow your own CAI credibility gap a little.

COMPUTER-ASSISTED INSTRUCTION

Interest Group Session

Charles Doty and
Edward Hauck, Chairmen[1]
George Brandon,[2] Consultant
Harold J. Mitzel,[3] Consultant

The consultants to the interest group on Computer-Assisted Instruction began the session with a description of the system, its capabilities, limitations, and suggested applications. In describing this system, Dr. Mitzel pointed out that it is going in two directions--toward the telephone or toward the cathode ray tube. The latter is especially good for instruction in vocational skills.

Today there is a greater understanding of these machines. The processes are becoming more precise as well as controllable. The life expectancy of a computer is about five years. Obsolescence occurs as new types of computers are developed. Older models can be sold on the open market--perhaps to another school. Much more research needs to be carried out in this field. Work is needed which will standardize computer programmed instruction so that computers by various manufacturers can be used. In addition, new methods of evaluation must be devised for effective measuring of the learning and retention from computer-assisted instruction.

The consultants also discussed the major hardware configurations that can be expected within the next few years. They pointed out that 1500 tests of industrial systems were now being completed by IBM. These systems were a combination of a cathode ray tube and a keyboard plus a tape. This system would be especially beneficial for young children, the handicapped, and college students. Ford Company and RCA are each developing similar systems.

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[2] Dr. Brandon is head, Department of Vocational Education, College of Education, The Pennsylvania State University.

[3] Dr. Mitzel is assistant dean for research, College of Education, The Pennsylvania State University.

Advantages of the System

1. It is useful as a tutor--it can be used with study guides.
2. It can accommodate students' questions.
3. It has tutorial and remedial advantages.
4. It possesses the capability to branch, accelerate, etc.
5. Forty hours to program one hour of instruction results in a carefully constructed program.
6. It is useful for problem solving segments of teaching.
7. It can accommodate learners with different needs.
8. It is applicable for adaptive education and the decision-making process.
9. Course writing is not excessively difficult--computer symbol system can be learned with a few weeks instruction.
10. A users group can form to produce programming and share equipment.
11. There are unlimited gadgets you can interlock to the computer, e.g., tape recorder--at random access.
12. There are no limitations on transmission over long distances.
13. The cathode ray tube is best for instructional purposes.

Disadvantages of the System

1. Compatibility between different brands of equipment does not exist to a great degree. (Manufacturers have not standardized.)
2. Preparation of programs is necessary, time consuming, and expensive.
3. It is difficult to get users group to agree on a framework for curriculum making.
4. Cost prohibits many users--$136,000 one year rental

for a 32 terminal computer. It presently costs $15-20 per student-terminal-hour--it is reducing.

5. Technicians are needed to operate equipment.
6. It is difficult to anticipate student questions.
7. There is a problem in scheduling students.
8. Lecture notes cannot be directly translated to course writing.
9. It is difficult to anticipate trouble spots in lessons.
10. It is difficult trying to adapt business machines to processes of education.
11. The typewriter as a teaching device is slow.

Values of the System for:

Administration-Computers can be of use in the decision-making process, college placement, record keeping, scheduling, and personnel selection.

Supervision-The system has limited application in this area because of the many variables in teacher education. It can be used to present simulated classroom problems and in the process of evaluation.

Teacher education-In this area, CAI can again be used to present simulated problems and classroom situations. It can also be of assistance in methods courses as well as in improving instruction. Training in CAI might create a new kind of teacher.

Instruction-Computer-Assisted Instruction helps to individualize instruction, to enhance teacher effectiveness, and to increase the quality of instruction by an extension of top educators.

Suggested Applications of the System to:

Agriculture-CAI could serve as a decision maker for farmers. It could also be applied in computerizing farm management courses.

Business and office education-The system could help in general business courses and in teaching the principles of retailing, advertising, etc.

Distributive education-CAI may be of assistance in retailing and cost analysis.

Health occupations-CAI can be used in disease identification and in the areas of anatomy and pharmacology.

Home economics-The system can be of assistance in budget making for the home.

CURRENT GUIDANCE APPLICATIONS OF COMPUTERS

Joseph T. Impellitteri[1]

If one were to stroll through one of the more progressive secondary schools currently in operation throughout the country today he might expect to see many interesting sights. He might observe a number of carrels where individual youngsters or pairs are viewing filmstrips and listening to synchronized audio tape recordings describing atomic activity in a chemical reaction, while others are watching a movie which explains the growth process of cancerous tissues in an organism. He will certainly see a busy data processing area consisting of at least a small to medium size computer and other auxiliary equipment used for class scheduling and processing of student grades. He might be informed at that point that there were several remote terminals connected to the computer located throughout the building where youngsters could sit down and try out a program they have constructed.

The evidence of television useage would be inescapable during the tour. In fact he just might stumble upon a television studio where programs live and taped would be produced.

If you ever find yourself in this situation, just slightly overawed and aghast at the spectacles you have seen, there is a sure method for sobering you up at this point. Ask directions to the guidance office. There, now, that's more like it--a dusty copy of the 1939 edition of the Dictionary of Occupational Titles on the shelf; the counselor busily at work hand-scoring some Metropolitan Achievement Tests; a well stocked and up-to-date bookshelf including the catalogs of every junior college, college, and university carefully filed from Aarduark Community College to Zulu University, and getting frantic use by twelve frenzied seniors; and lastly you recognize the familiar $347.00 file of occupational literature (price of file cabinet included) which has yet to feel the first student's anxious grasp. You now find yourself back in a world of reality.

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[1] Dr. Impellitteri is an assistant professor in the College of Education, and project director of Computer Assisted Occupational Guidance at The Pennsylvania State University.

SYSTEMS UNDER DEVELOPMENT

There are, however, several developments underway at this time which could prove to be of great use to the guidance counselor in complementing his current activities. Those I will mention are vocational guidance aids rather than educational or personal guidance aids. Two closely related reasons why the area of vocational guidance is currently attracting the attention of researchers are: 1) the problems are more acute than in the other areas--the typical academic counselor bound by middle class values and unwilling to cope with problems of career development--the changing nature of the world of work with its increasing demand for technological knowledge on the worker; and 2) the stimulation of research funding from the 1963 Vocational Education Act.

David Tiedeman and his associates at Harvard are developing an Information System for Vocational Decisions (ISVD) in cooperation with the Newton, Mass. school system and the New England Educational Data System (Needs). When operational as a prototype system (projected July, 1969) it will make use of student and worker characteristics, facts about occupations, education, military service and family. These facts will be placed in computer storage and anyone from a third grader to a 60 year old bricklayer out of a job will be able to make inquiries of the computer through some type of console device, test out tentative decisions on it, and obtain feedback from it.

Frank Minor at IBM, working with Donald Super and Roger Myers of Columbia, is developing a computer-assisted vocational guidance program utilizing similar equipment as was seen in the film that was just shown (IBM 1050 terminal connected with an IBM 1400 series computer). The approach they have taken is to proceed with a ninth or tenth grade youngster from his knowledge of various aspects of the world of work, exploration of the concepts of field of work and level of work, and then eventually to discussions of specific occupations within certain fields and levels.

William Cooley, formerly of the American Institutes for Research and now at the University of Pittsburgh, has developed a computerized scheme whereby youngsters (ninth through twelfth graders) can obtain actual probabilities of their chances of success in any one of six major fields of work. These data have been developed on the basis of the Project Talent results.

A DESCRIPTION OF THE PENN STATE PROGRAM

At Penn State our purpose is to develop and evaluate a system of presenting occupational information to ninth grade pupils, utilizing the computer-assisted instruction facility currently in operation there. This system will provide a model for a more extensive, extremely flexible, easily updated information-giving system.

One of the most unique features of this system is that of selective presentation of occupational information. The selection of the materials to be presented to the individual student is based on that student's General Aptitude Test Battery (GATB) profile which is stored in the computer memory. Another of its unique features is the manner of presentation of the materials. Not only are materials typed out at the console where the student is to be seated, but also are presented on sound recordings and slide projections, all integrated under computer control.

This system is visualized not as a substitute for the counselor, but as an effective complement to the counselor. It provides the function of information-giving, that portion of the vocational guidance process which counselors are admittedly less adept to handle, and more willing to delegate. The role of the counselor in vocational guidance as presented here in conjunction with this occupational information system is thus revised. His responsibilities no longer include knowledge of specific facts about particular jobs, but instead involve the understanding of the world of work, its relation to individual goals and aspirations, and the ability to communicate effectively with the student in these terms.

The computerized occupational information system may be thought of as a powerful tool of the school counselor in the vocational guidance process. The school counselor must become actively involved if this "tool" is to be effective. Outside of the vocational guidance process the system has little utility. The system thus will function effectively only in a school where the guidance counselor acknowledges the value of vocational guidance for ninth grade pupils and recognizes the need for them to acquire knowledge about occupations.

The unique advantages of the Computer Assisted Occupational Guidance system are its flexibility and its storage capacity. Its flexibility allows for innumerable changes in the existing system--changes in certain aspects of existing job descriptions such as educational requirements, employment outlooks, or work hours per week; the addition of new job descriptions; or the deletion of certain jobs which are being phased out of existence.

The practically limitless storage capacity of the system allows for many job descriptions to be stored in addition to innumerable characteristic student profiles. Any changes that occur in jobs and employment opportunities as well as up-dated student information can be immediately entered into computer storage.

In what ways will the computer-based occupational information system more adequately meet the needs of ninth and tenth grade pupils? First, since the interaction is with the student, independent of counselor involvement, all students will be offered the opportunity to obtain occupational information, not only those selected students for whom the counselor has time available. Second, the occupational information that is presented to the students will be accurate and up-to-date, resulting in the more realistic transmission of opportunities in the world of work. Third, the manner of presentation of the occupational materials via typewriter, tape recordings and slide projections will instill greater pupil interest, and consequently greater pupil growth in knowledge of the world of work. Finally, the selective nature of presentation of the occupational information will result in pupil acquisition of a more adequate picture of himself in relation to the world of work.

Through the development of the system, including only a limited number of occupational groupings and specific vocational trade and industrial job descriptions to be presented to ninth grade pupils, it is expected to establish a prototype for a more comprehensive system in the future. Each pupil using the system is allowed to cover as many specific occupations for which he has the time and the inclination. Each grouping and specific job he does review, however, will be presented in relation to his own aptitudes and interests. The materials presented are thus pertinent, meaningful occupational information.

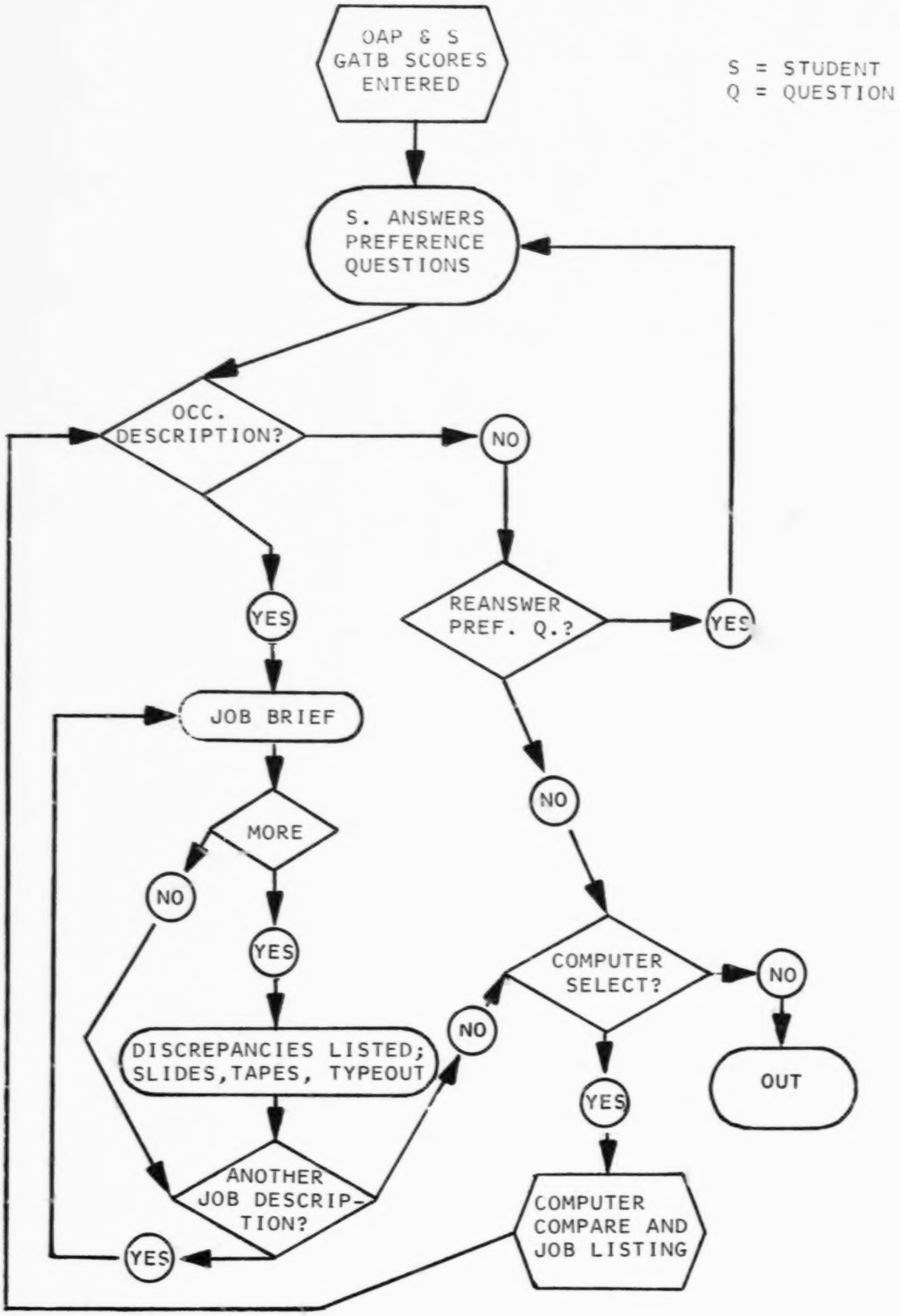
The result that is expected is the more realistic, intelligent choice of a vocational goal to give some meaning and direction to the rigorous training and/or rigorous educational pursuits involved in attaining such a goal.

CURRENT USE AND FUTURE DEVELOPMENTS

We have recently tried out a tentative program at Keith Junior High School in Altoona, Pennsylvania with about 75 ninth grade boys who were selected because they had indicated some interest in a vocational or technical training curriculum at the senior high. The program included descriptions (including slides and recorded interviews with workers) of 40 occupations and was designed to operate in accordance with the flow diagram on the following page.

The reactions we received from this group of boys was quite interesting. They felt that the information they received was quite helpful to them. They told us not to get too excited about the slides and tapes we presented--it was the typeout that they felt was more interesting and important to them. They felt that the length of each session they had at the terminal was much too short (40 minutes). They indicated a preference for one to one and one-half hour sessions at the terminal. Next year we have planned to do more testing of a similar program as that tried out in Altoona. We also are developing a program which includes a more representative sampling of occupations divided into occupational categories.

Hopefully within the next five years we will not only have developed an operational guidance tool but will also by able to provide evidence related to its effectiveness and applicability at the various stages of career development.


OAP & S GATB SCORES ENTERED
S = STUDENT
Q = QUESTION
S. ANSWERS PREFERENCE QUESTIONS
OCC. DESCRIPTION?
NO
YES
REANSWER PREF. Q.?
YES
JOB BRIEF
NO
MORE
NO
YES
COMPUTER SELECT?
NO
DISCREPANCIES LISTED; SLIDES,TAPES, TYPEOUT
NO
YES
OUT
ANOTHER JOB DESCRIPTION?
COMPUTER COMPARE AND JOB LISTING
YES

COMPUTER-ASSISTED COUNSELING

Interest Group Session

Marla Peterson,[1] Chairman
Joseph Impellitteri,[2] Consultant

The consultant described the occupational guidance project at The Pennsylvania State University and responded to questions by the participants about evaluation of the project, use of the counselors' time, and the selection of materials. The participants discussed the application of computer-assisted occupational guidance to vocational and technical education.

The Computer-Assisted Counseling Project at The Pennsylvania State University is attempting to assist students in their choice of a career. Tape recorded interviews with employees in 40 different occupations have been recorded. A series of colored slides are used in connection with the interviews. Four slides, showing the type of clothes the worker wears, the type of work he does with his hands, etc., have been produced for each occupation.

The General Aptitude Test Battery is administered to each student wishing to seek career information. The results of the General Aptitude Test Battery are stored in the computer.

A student may select an occupation that he wished to explore. With the information which was gathered by the GATB, the computer then proceeds to ask the student questions such as, "Do you plan to complete four years of high school?" The computer continues to ask the student questions which focus on the particular career that he is exploring. It is hoped that through this process the student will have a more realistic view of the type of work which is involved in each occupation.

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[1] Mrs. Peterson is activities coordinator, Business & Office Occupations, The Center for Vocational and Technical Education, The Ohio State University.

[2] Dr. Impellitteri is assistant professor of vocational education, The Pennsylvania State University.

Advantages and Disadvantages of the System

This form of computer-assisted counseling is aimed mainly at the upper junior high school or lower senior high school levels. All areas of vocational and technical education could benefit from computer-assisted instruction. More realistic job choices could be the outcome in all areas.

The participants noted that in order for the counselor to make effective use of the results which the computer obtained, it would be necessary for the counselor to become familiar with the tape recorded interviews and the slides which correspond with the particular occupation the student is exploring.

The project has no indication of the effect computer-assisted instruction will have on directing the students to the guidance counselor for additional counseling and assistance in making decisions and career choices. There is no information on how the student accepts the facts which are given to him by the computer.

This system may not save the counselor any time. In fact, it may require more of his time to become familiar with all the materials which are available in the various occupations. However, computer-assisted counseling will help the counselor give more realistic views of what the occupations involve.

The groups of counselors who have visited the project at The Pennsylvania State University have reacted positively to this type of procedure. The project's main emphasis is on career guidance and at this time has not chosen to direct its efforts toward any other type of computer-assisted counseling.

Further research on the materials used in the system is needed before they can be distributed for general use.

COMPUTER ASPECTS OF COMPUTER ASSISTED INSTRUCTION AND COMPUTER ASSISTED COUNSELING

Interest Group Session

Harold L. Carr,[1] Chairman
Scott Kostenbauder,[2] Consultant

The consultant presented in-depth information about computer systems, program development, and applications to education. He discussed present and future developments in computer hardware and described the need for the organizing of service agencies to dessiminate information and share services. The participants suggested applications to vocational and technical education.

Computer assisted instruction (CAI) and computer assisted counseling (CAC) programs are experimental and any information relating to these programs should be treated as experimental. Schools and user groups should be cautioned not to purchase equipment for CAI or CAC and then try to decide what to do with it. A survey of educational needs must first be made and one or two significant programs could be selected for improvement. These programs should then be integrated on a limited trial basis with maximum involvement on the part of the teachers, supervisors, and administrators.

Current CAI and CAC systems are using the 1400 series computers with modified IBM 1050 type terminal units. The terminal unit contains a Bell-Dataphone for computer contact, a typewriter to provide a record of pertinent information, a tape recorder to present facts and information, and a slide projector to graphically present and illustrate specific information. Teletype terminals are available but lack the audio-visual displays.

The present terminal hardware provides slow access to audio-visual material. Future hardware will allow a more rapid access and expand the capacity to approximately eighty slides and ninety minutes of audio tape per course. Cathode-ray tubes (CRT) may be added to the terminal for visual display but are limited to graphic line drawings and figures.

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[1] Mr. Carr is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Kostenbauder is a research assistant, Computer Assisted Occupational Guidance, The Pennsylvania State University.

Development of any projected CAI program should be made in five steps: (1) define objectives; (2) select instructional strategies; (3) write the program; (4) translate the program to numerical language; and (5) evaluate the course after use to determine if the objectives were met.

"Course Writer Language," the symbolic language for writing programs, was developed by IBM. Training in this language requires approximately one week. The language requires the knowledge of twenty different codes to instruct the computer to branch, to test, to accept a partial answer, to show a slide, or to operate a tape recorder. The time consuming operation for teachers is the acquisition of experience in using code functions.

To develop a program, teachers must set up instructional frames including questions, answers, slides and tapes, according to educational desires. The teachers must anticipate student responses and know all the CAI strategies. All input must be set in sequence and is based on human pre-decision. It has been found that it requires approximately forty minutes of preparation time for one minute of computer time.

Advantages of the System

1. CAI programs can be written to compensate for individual needs. They do not have the limitations of most teaching machines and programmed learning devices in branching ability.

2. The computer is capable of all four programmed teaching modes; a linear sequence, forward, backward, and combination branching. Branching can be handled with or without the student's knowledge and can direct him at his own pace.

3. CAI programs have produced a higher rate of retention, acceleration of curriculum and training, and uniformly high teaching standards.

Disadvantages of the System

1. Incompatibility among computers to accept different programs hinders the use of present CAI courses.

2. Problems exist in language translation from one program to another.

3. Programs are difficult to write for efficient branching.

4. The cost averages $18 to $24 per hour for terminal and computer time.

5. Service agencies are needed to develop and exchange programs and information.

Value of the System

CAI has many implications as the shortage of teachers in vocational education becomes more apparent.

One master teacher can write a course which will adjust to the ability and prior knowledge of students in many different situations.

The computer can be used as a laboratory calculating device, a record keeper and retriever of student information, a problem solving or model simulation device, a homework monitor or recitation reviewer, or as a tutor.

Suggested Applications of the System

Programs in CAI can help update the school curriculum to keep in step with changing technology, and courses can be developed in teacher in-service training.

CAI courses have many uses in training and retraining of the handicapped and unemployed.

Adult education programs could progress more rapidly with CAI since the range of abilities and prior knowledge is so great.

CAI permits more teacher time for personal contact and group interaction, without the traditional class lecture, thus enabling larger groups of students to be served by one teacher.

Facilities Implications of the System

Large areas are needed for the installation of the necessary equipment. These areas also require special air conditioning equipment.

Future trends indicate the use of terminals in dormitories for study purposes and information retrieval. Terminal equipment and satellite relay stations could make courses and interchange of information available on a world-wide basis.

A SMALL COMPUTER FOR USE IN TEACHING COMPUTER FUNDAMENTALS

Interest Group Session

James Bennett,[1] Chairman
Arthur Holt,[2] Consultant

The consultant described the small computer and its application to secondary and vocational and technical education. He then reacted to questions from the participants.

Fabri-Tek Incorporated, Minneapolis, Minnesota, is the producer of the Bi-Tran Six Computer Educational System. Basically, the system is a small, modern computer which has the functions of full-scale operational computers. Certain teaching functions have been designed within the unit which permit the educator to pursue teaching objectives from simple numeric instruction to rather complex elements of computer design--all with the same machine.

The system functions as part of a teacher-centered learning cycle, designed to increase student motivation and knowledge transfer. Fabri-Tek has a continuing program for the development, writing, and publishing of course material to aid the instructor in teaching computer science.

The system is not a computer designed to do standard operational work. It is a unit designed exclusively for teaching computer science. It is a working computer, and it is not a laboratory mock-up which merely simulates the operation of a computer. The unit is not intended for "black box" problem solving or single purpose training such as teaching computer language (Fortran and Cobol).

The system is designed solely to help teach fundamentals of the following computer science subjects:

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[1] Mr. Bennett is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Dr. Holt is a consultant, Fabri-Tek Incorporated, Minneapolis, Minnesota.

Binary arithmetic--all binary functions are readily demonstrated.

Computer machine organization--the unit is a complete computer with typical system organization.

Computer logic--all modern circuitry is used.

Programming and program debugging--step-at-a time program review.

Computer circuits--solid state computer circuits are used.

Computer operation--each phase of operation is controllable.

Computer arithmetic--timing and control algorithms.

Boolean algebra--correlation of hardware and equations made simple.

Computer maintenance and troubleshooting--all circuits can be exposed and have socket-mounted transistors for easy debugging.

Computer memories--the computer has a coincident-current ferrite core memory.

Advantages of the System

1. The unit is a genuine low cost computer ($6,000-9,000) which has the operative functions and circuitry of an operational computer.
2. The system may be interfaced with auxiliary equipment such as paper tape punch, paper tape reader, paper tape strip printer, and bi-octal converter.
3. The unit is lightweight and portable, weighing only 98 pounds and requiring the standard electric outlet.
4. The latest electronic circuit elements make up the components. (All solid state components are used.)
5. Students can interact with the machine and see the response.

6. Available support materials (operation and service manual, teacher's manual, student workbooks) provide a complete course in basic computer instruction.

Disadvantages of the System

1. The unit has a small memory, limiting the unit to 100 step problems or less.

2. The unit is not a production device but an instructional tool designed primarily to aid in the education process. Many schools want a production-education oriented computer.

3. While the unit is described as being portable, no handles are incorporated to ease transporting.

Value of the System for:

Administration-There is little or no administrative value. It is not designed to do standard operational work.

Supervision-There is no apparent application to supervision as the unit is not production oriented.

Teacher education-It is an ideal training tool in introducing basic computer theory to teachers. It has great utilization in preparing computer technology teachers by introducing them to: programming, computer organization, Boolean algebra, computer logic, memory systems, circuit theory, and maintenance programming and debugging techniques.

Instruction-The unit may have some basic value in demonstrating the use of new math to high school teachers and students.

Suggested Applications of the System to:

Technical education-The unit can be used in teacher preparation and in computer serviceman preparation.

Mathematics-It can provide for student reinforcement in mathematics and problem-solving skills.

Business, office and distributive education-The system can be used to teach principles of computer application, principles of computer programming, the structure of computer logic, and maintenance of computer systems.

MICRO-TEACHING

Dwight W. Allen[1]

It is a pleasure to be with you and share some of our research and development findings by using a technique called micro-teaching. I'm not sure that we at Stanford can say that we invented the process; any time you make a claim like that someone else can always come up and say that they were three days ahead of you but, if we didn't invent micro-teaching, at least we gave it its current name.

I wish we were smart enough to say, "We saw some problems in teacher education; we saw some problems in supervision; therefore, we needed to dream up a process to deal with these problems." Then we could say, "We thought, and we thought, and we thought, and finally said, 'Aha, micro-teaching!'" Then we sat down and wrote a manual about it and there it was. That's not the way it happened and at the risk of telling you more about penguins than you may care to know, I would like to tell you a little about how we developed the process of micro-teaching.

Oftentimes, the way things get reported, it's as Beveridge says, "It is for the good of the art of scientific investigation." He gives a little analogy, saying, It's like a mountain climber climbing a mountain for the first time. He claws his way up on the mountainside, he gets stuck and backs down, and he goes up again, and he backs down, and he gets way out on a limb and scratches his shoulder in leaving. Finally, he makes his way to the top of the mountain. When he gets to the top of the mountain, he looks about him and he sees a royal road, so he goes down the royal road and tells everybody else who's going to climb this glorious mountain about the royal road, never telling them about scratching his way up the other side in the process of finding that royal road! (1957) Well, I'd like to tell you a little bit about scratching up the other side, because I think in reporting scientific progress of any kind, and in education in particular, we're a little bit short on telling people about the scratchy road up the other side.

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[1] Dr. Allen is a professor of education, College of Education, Stanford University.

DEVELOPMENT OF MICRO-TEACHING AT STANFORD

We really developed micro-teaching as a defense mechanism. We had a problem in teacher education at Stanford; namely, we were dealing with about 150 very bright liberal arts candidates who were participating in a fifth year program of teacher education--only they weren't "having any." They were quite content because they were so well prepared in their subject area that they believed they could teach without any teacher preparation whatsoever. They were simply, barely tolerating the process by way of getting something called a union card. We lamented this because--you know the old story about you can't do anything until you get their attention first. We were concerned that we really didn't have their attention. So we decided that what they needed was a little dose of "the real world" early in the training process! We dreamed up something called a demonstration teaching lesson.

This demonstration teaching lesson was designed to harass them, pure and simple, and what we did was give them four students to teach. This was in a little seminar room and the four students were put at the ends--you know at the extreme corners--of very large seminar tables, to give them a very unteachable group. We turned off the lights and drew the blinds to make it look like a cocktail parlor. We pulled the screen down over the blackboard, leaving about a foot of blackboard all the way around, so they either had to pull up the screen or write all the way around it--eighty percent wrote all the way around it. We then gave them some game material to teach. We made this game up so that we knew they couldn't know it ahead of time; we called the game "Itsy Witsy."

We gave them an hour to learn the game, and they taught at least four students, all of whom were role playing. The first student role-played "Eager," and whatever the teacher did Eager was right there nodding and smiling and cooperating, and every time the teacher would say, "Frog," Eager would jump. And there was just nothing the teacher could do to make Eager other than a very, very, lovely, satisfactory, delightful learner. The second learner was "Slow-poke," and Slow-poke just never did quite catch on. The third learner was "Know-it-all". Every time the teacher started to explain something about the game, Know-it-all would anticipate it, "But you forgot to tell them about such and such," or "Don't you think you ought to mention this first?" or "No, you're explaining that wrong." You see, Know-it-all was to be counted on for always correcting the teacher and being very helpful. The fourth person was "Couldn't-care-less." And Couldn't-care-less was folding model airplanes, talking with his neighbor, playing with the game pieces, and finally, about halfway through the lesson, he got up and walked out.

We were very successful with this demonstration lesson. The trauma was indeed great; we left them lying on the floor completely bewildered. We even had a double whammy. The first whammy was the lesson I just described; the second whammy came the next day when all the teachers had to sit in class and listen to all these precocious kids tell them all the things they did wrong. You know, like saying, "All you had to do was to explain it just a little bit differently and Slow-poke could learn." "All you'd have to do was just say one nice thing to Know-it-all, to say something like 'Oh, I'm glad you know this, maybe you can help me or help the other kids,' any nice thing to Know-it-all to take recognition of the fact that Know-it-all did know the material. Then Know-it-all would have been an ideal student for the rest of the time." "All you had to do was say anything that could control Couldn't-care-less." "Just say, 'stop it,' or 'please,' or anything to control Couldn't-care-less, and Couldn't-care-less would be a model student." So, the second whammy was to tell them, in effect, "You know, it would be so simple if only you'd know how to teach." "You see, you forgot to roll the screen up to use the blackboard, you forgot to turn on the lights--there's no reason for that. You didn't have the kids come around the table to be a teachable group at one end. It's all so very simple, you know; here you are, very bright liberal arts graduates, why didn't you do these very simple things to be an effective teacher?" Indeed, we left them lying on the floor.

The only problem was: now they were ready to learn, but we didn't have very much medicine to give them. That was a problem because we have found in our project over the last eight years that the medicine in teacher education is a little bit wanting; that's why our reputation is as bad as it is. Part of it isn't deserved and part of it is. But from that very artifical, initial situation, gradually we made it more and more constructive. For example, we allowed them to teach their own material rather than forcing them to teach the game material. Gradually, we reduced the role playing. Then we finally cut the role playing entirely and let the students simply react normally as students, and, within about three years, we had developed the process of micro-teaching as we now use it. Today we take a positive training procedure rather than a negative/traumatic introduction to the process of teaching.

That's the kind of mountain we clawed up the other side of; thus, micro-teaching isn't really any kind of an orthodoxy. I'll be giving you some "for instances" in terms of how we've been using it, but it's not an orthodoxy; there's no particular length of time that a lesson must be, or a particular size of class you must teach to, or particular protocol in terms of the way in which the lesson is constructed, or the way in which it is supervised. There are many, many variations in which the people using micro-teaching can exercise all sorts of creativity; but basically, micro-teaching is real teaching.

CHARACTERISTICS OF MICRO-TEACHING

It's very important to realize that micro-teaching is real because most people start off thinking that it is simulated or laboratory or something like this; it is real teaching. It is real teaching because the students are always real students at the grade-level at which the lesson is being taught. In other words, if you are training teachers at the secondary level, you use secondary students; if you're training teachers on the elementary level, you use elementary students; if you're training them at the college level, you use college students. They are always at the grade level at which the teacher is being prepared. The students are always seeing the material for the first time. That's very important. If you're going to teach the same lesson again and again and again, you have to bring in different kids each time; otherwise, it is not real teaching. The third time through a lesson it is hard to keep it realistic. The kids, by this time, are automatically role-playing even if they are trying to be real students.

Micro-teaching is scaled down--by that I mean it isn't full size. It is scaled down in terms of the number of students --typically between three and five students rather than a class of 30. It's scaled down in terms of time; the lessons we use vary in length between 5 and 20 minutes. Most of the individual lessons are five minutes in length. The importance here is the fact that this is economical of the trainee's time and economical of the supervisor's time. It is constructed. Since we are constructing the teaching-learning situation, if we want to have a class at 6 o'clock Saturday morning, we have a class at 6 o'clock Saturday, or at 11 o'clock at night or whenever. We construct the teaching situation at our convenience. This is particularly important for in-service education where you can provide in-service teachers with real teaching experience outside of normal class hours. Another asset to the constructed part of it is that if we want to have the same teacher teach the same lesson to different groups of students, we can do this.

Our basic cycle in micro-teaching--in the individual lesson--could be a teach, a critique, a re-teach and a critique; these four elements in our individual lesson cycle can all take place within a half hour. A teacher can have an opportunity to teach a lesson, it can be critiqued, the teacher can teach it again, it can be critiqued--all within the space of a half-hour which is very economical of both the trainee's and the supervisor's time. This is true both of pre-service applications and in-service applications.

EQUIPMENT CONCERNS

I would like to start out this morning by showing you some of the micro-teaching we have used at Stanford and some of the applications that we've used it in. The quality of the tape is not very good; don't blame the gentleman who brought the recorder for the quality of the tape--it's our quality. We have put the emphasis on what we call training quality and we don't really mind some of the things that a person who is a first-class technician or electronic engineer minds. We just want it to be of sufficient quality so we can use it, so we will put up with a lot of irregularities that are not satisfactory if you're trying to demonstrate the potential of a recorder.

First of all, let me show you the equipment that we use and the way in which we use it. This is a recording unit. It's mounted in the bottom of a portable cart--and by portable our definition is, it must be able to be set up or broken down within the passing period of a classroom. In other words, we say it isn't portable unless you can put it together and take it apart in four minutes. We have a console on top and we have a monitor built into that console. This is important because this means that the cameraman doesn't have to sight down the camera when he is recording but rather looks down at the monitor in the console. All of our electronics are patched into a single board which means that when we go into the classroom we only have to plug into one power outlet in the wall, reel out a microphone cord, and we're in business. All the audio and video are patched together. The camera is simply mounted on the top of this same cart. The cart can be hauled up and down stairs on a refrigerator dolly and can be handled by one man. This last year, using this basic cart configuration, we made about 3,000 classroom recordings in approximately 110 schools--so we're talking about real portability. Now, unfortunately, in most circumstances, portability means the kind of thing that you see here this morning--you carry in a recorder in a big box, then you carry in the camera, then the monitor--and portability is usually an hour or two to set up. This makes an unreasonably "big deal" about portable television recordings in the classroom.

The camera that we use is mounted on the top of the cart. We carry that whole system around in a little van or on trailers. We use undergraduate cameramen and pay them $1.75 an hour; we train them in about three hours to make the recordings. One of the important things about this protocol is the fact that we have to count on losing about five percent of our recordings. We would have to work terribly hard to get 100 percent effectiveness whereas with the reasonable training protocol we can get 95 percent.

One of the things that we think is very important for educators to realize in working with sophisticated electronic equipment like video recorders is that you have to make a basic decision as to whether or not you're going to control the equipment or the equipment is going to control you. Too often I've seen setups where the equipment controls you. I went back to a university that is known for its video facilities and wanted to put on a demonstration of micro-teaching. They were going to make their own tape. First, we don't work in studios, primarily we work in classrooms, but we were in the studio and I said, "Alright, I'd like to have the students here." They said, "Well you can't have the students sit there." I said, "Why not?" and they said, "Because of mmm mmm mmm mmm mmm and the light and mmm mmm mmm mmmm." I said, "Where can I have the students?" "You can have them right here." "Okay, we'll put the students here." "Now, I'd like to have the camera there." "Well, you can't have the camera there." I said, "Where can the camera be?"; "The camera can be over there." "Alright, put the camera over there." By the time that we got finished, the kinds of things that we were trying to demonstrate were completely sabotaged by the requirements of the technician; we got a beautiful picture of the wrong thing. It seems to me most important that if the videotape is going to be a tool, that it's used to meet the requirements we want! So the lighting isn't ideal, so the sound isn't perfect; if we get the right picture even if it's a bit fuzzy and a little bit off in places, it seems to me that this is superior.

The first thing that I would very strongly recommend is that you resolve, if you're going to use this type of equipment, that you use it under educator control rather than technician, and then the responsibility of the technician is to do as good a job of recording given the possible educational parameters. Then you have to be prepared for all sorts of compromises. For example, when using undergraduate cameramen that have been trained for three or four hours, occasionally they'll forget to take something with them to the classroom, and that something sometimes can completely ruin the recording. Or sometimes they will erase your prize tape completely by accident. But if you decide ahead of time that this is all part of the parameter that you're willing to live with, then it isn't a matter of concern. It's a matter of concern, but it isn't a matter of extreme unction when these kinds of things happen. We simply plan on about five percent casualities in our recordings. We plan on that and when something breaks, or something doesn't arrive on time, or something else happens, we just don't get excited. That's part of the cost of doing business and in return for that we are able to use relatively unskilled people who are completely willing to meet the requirements that we want them to meet in an educational process. We find that the use of undergraduate cameramen is highly satisfactory.

We have two vans and two trailers. Some of our cameramen who don't have their own transportation use the little vans. For the ones that do have a car, we buy a trailer hitch for their car and they get paid mileage for hauling the trailer around. This reduces the emphasis on that part of the technology--makes it routine.

We have some 14 video units that we are using. We started out with one. We had the very first portable videotape recorder available from the very first manufacturer. In fact, we had a prototype unit for three months before it came on the market and then we had their manufacturer serial number 1, so we've been using video tape for quite a long time. We get everybody mad at us; for example, on three occasions we've had the recorder on these little carts and the whole cart dumps over and throws the recorder on its head. We find the recorders are quite durable--one time it did $35.00 worth of damage to the case; one time we had to replace one of the electronic panels; so the point is that if you make a big deal out of it and if the equipment is like pure gold that you have to really care about, then you can't use it. We had the manufacturer's representative for the camera come out and he looked at the way the camera was dented --we had one camera dented to the point where we couldn't get the vidicon tube out--and he said, "It's criminal to treat a camera that way. We shouldn't let you use cameras if you're going to use them that way." The point is that this camera was a wonderful veteran of many hundreds of classroom recordings, and it had been bumped up the stairs and down the stairs and into the wall, and it did a fine job. We were completely happy with it, and we didn't even mind having to retire it after a while, even though the technician assured us that this was a premature retirement. He sort of accused us of murder. It's not that we don't want to take care of the equipment, but we say we're going to use the equipment the way we want to use it; and then we're going to have to repair it and patch it and do whatever else is necessary to keep it working, but we're going to use it the way we want to.

You could become overawed by the equipment. You could say, "Oh, this is a $20,000 set up (this goes back before the price of video recorders came down) and you could get all excited about that $20,000 investment. Now, a cart-- completely equipped the way we use it--is between $7000 and $9000 for an intermediate recorder such as the Ampex 7500, the one we're using today. I don't want to spend a lot of time on equipment, but I want to spend enough time on equipment to give you a philosophy for the use of the equipment.

First of all, it's important to realize that micro-teaching doesn't require video tape. Micro-teaching uses video tape, and video tape enhances the process, but you don't have to have video tape to have micro-teaching. One of the largest micro-teaching clinics now in use is down in Bogota, Columbia--and they don't have a recorder within hundreds of miles. So you don't have to have the video tape. The first year of our micro-teaching clinic, we video taped one-fourth of all the lessons; the next year, one-half; and now we video tape all of our lessons because we have the equipment available and because it enhances the process. But you do not have to have video tape in order to use the process of micro-teaching.

IMPLEMENTING MICRO-TEACHING

Remember that in the tapes of our teachers we are going to be seeing something which I will call the "golf-grip phenomenon." That's a fancy psychological term for something I think is very important in teacher education. The golf-grip phenomenon is like this: Someone shows me a new golf grip and says it'll take ten strokes off my score; I go out and try the thing and instead of taking 10 strokes off my score, it goes up 10 strokes. If I evaluate this new grip at that point I have to say that it's not very good. Ten rounds later, however, I might be even, and ten rounds after that I might be getting some of the benefit of the new grip. In the same way, mind you, we try to teach teachers to use a different technique of some sort. The first or second time they use it we evaluate whether they're doing well.

I submit that the golf-grip phenomenon is terribly important. Furthermore, micro-teaching is terribly important here because micro-teaching offers teachers an opportunity to learn new techniques under safe circumstances. Namely, they can teach and fall completely on their face and four new kids are brought in. If they fall on their face again, we bring in four new kids. We can bring kids in as long as they want, and the kids are never dependent on that teaching for their learning. We pay the kids $1.00 an hour to be learners, and we don't care if they learn or not. We care but that isn't the object of it; the object is to provide the teacher with a teaching situation. So it's a very safe pre-service and in-service technique.

An experienced teacher is very, very reluctant to try a new technique that she failed in. If she tries a new technique and fails at it once or twice, I can pretty well guarantee that an experienced teacher isn't going to try that technique anymore. Whereas, if I can give that experienced teacher an opportunity to try it in micro-teaching, without her own students, she'd be in a completely neutral setting. The teacher can try it and not do well, try it again, try it again, and start getting the feel of it. I call this the golf-grip phenomenon.

We have to be very careful of the point at which we evaluate something. You know, it's just like the use of any kind of new technology. I'm reminded of the story of the first time the horse and the steam engine ran a race--the horse won. The first time you use video tape, it may turn out awful, and the second time, and the third time. The first time the teacher is trying a new technique, it may turn out awful--the first time, the second time, the third time, and sometimes the 23rd time. The important thing is, "Can we help teachers extend the range of alternatives available to them as professionals?" Once we've extended the range of alternatives available, then we go on to an even more important part of teacher education, namely, dealing with professional decisions of when to use what. You can't talk about when to use what until the teachers have genuine alternatives available. Consequently, our whole strategy is to give the teachers a wider range of alternatives and then talk about the even more important part of teacher education which is when to do what in the professional decisions.

I would like to show you a pair of diagnostic lessons. This is a diagnostic lesson of one of our intern teachers beginning her training the early part of summer, and then the same intern seven weeks later at the end of summer preparation. Remember, this intern teacher has not had any preparation in education as an undergraduate, and on the very first day that she arrived for the program we said, "We want you to teach and show us how you can teach. You can teach a five-minute lesson of your choice. You can teach anything you want." And this is the result. (Videotape was viewed.) I'd like to point out two things. First of all, we only saw about one minute of the five-minute lesson. Almost everyone who first sees microteaching says five minutes is too short a time to teach a decent lesson. I would like to point out that in one minute I am absolutely sure I can predict with deadly accuracy, that you can predict exactly, what the other four minutes of that lesson is going to be like. You see, it turns out that five minutes is a long, long time.

I'd like to point out that this teacher is suffering from two of the things that teachers suffer from chronically at the beginning of their training--and many teachers never get beyond it. That is: Number one, she was trying to cram too much into the lesson. She was modestly trying to teach the transfer food process in five minutes--a rather modest undertaking. Secondly, I would like you to notice the other thing that is characteristic of beginning teachers--how scintillating the interaction was with her class. Again, I submit that there would be no difference in the terms of the way she was teaching if there were four kids there, or 400. She was teaching a class of four students, but I submit that we don't have any trouble at all to get four students to simulate a full-size class. Quite the contrary, we have trouble getting the teachers to teach four students as if they were four students--as if they were a small group. Note that the process comes out a lot more real than you might imagine at first glance--that it is real teaching.

During the summer this girl was given some very specific types of training. We have a philosophy at Stanford when we talk about technical skills of teaching, and we say that if you want to compliment our program, say that we have a very large bag of tricks. We don't apologize for a bag of tricks at all. In fact, we are proud of the fact that we have a bag of tricks because these types of tricks, we hope, provide teachers with alternatives--and one of the things that teachers are shortest on is alternatives.

In other words, if I only have two ways of disciplining a class then I really don't have any professional decisions to make--I can chose one of those two ways. Many teachers only have one way of handling a situation, and they always handle it the same way whether it is something very sophisticated like inquiry training or something very routine like making assignments. Most teachers don't have many alternatives for making assignments; they always write it in the upper left hand corner of the blackboard and it's always there when the kids come in at the beginning of the class. I submit that that isn't a very sophisticated level of teaching when it comes to using a teaching technique, namely, making assignments. So you can ask all sorts of questions. Is that the proper time to make the assignment? Is the proper information there? Might it be better to ditto it and give it to the kids rather than to write it on the board? Have you individualized the material so that students who need more information get it? Have you used any techniques of efficiency so you know that you communicate this in a minimum time? Have you answered the questions of the students that have questions without boring those that didn't have questions, and so on? You see, I can take a very small routine, pedestrian part of teaching, and ask many embarrassing questions that most teachers, most experienced teachers, most 20-year veterans, are not going to be able to deal with very well. So, when we are dealing with the technical skills of teaching, we don't apologize for dealing very specifically with specific levels of skills.

TEACHING SPECIFIC SKILLS

During the course of the summer we train our teachers in about half a dozen skills. We don't have, and furthermore, we haven't identified all the technical skills of teaching. We have identified some of the technical skills that we think are important for teachers to know. To give you a few examples, one of the skills is called "Set-induction," getting the kids ready to learn and getting them oriented to what you want to teach. There are a whole group of skills in the questioning area involving the students in the work: developing more high-order questions; probing--not accepting the first answer you get from the students; encouraging student-initiated questions--all of these are specific questioning skills.

Lesson Closure

Another skill is how to bring about lesson closure. One of the things that we have found, for example, is the large difference between something called teacher closure and something called student closure. Teacher closure can be described as follows: the teacher is teaching away; he looks at his watch; sees that there's five minutes to go and he's only half way through the lesson; he starts exploding information; and, at the end of five minutes, he breathlessly comes to the last period just as the bell rings. That's teacher closure. However, the kids stopped learning when he started galloping through his material. Student closure is when the students feel that the lesson has come to an end. Our experimental research at Stanford demonstrates that learning is highly correlated with student closure and is not correlated at all with teacher closure. Again, most closure in the classroom is teacher closure, not student closure. So we train teachers in these kinds of skills.

I would like now to show you the way that Miss Blank taught at the end of her seven weeks. She still hasn't taught a regular class; the only classes she's taught have been micro-classes. Notice that she has narrowed down the subject matter--she's teaching a more reasonable lesson. Notice that she's a little more animated. We'll show you two excerpts from her final lesson, one at the beginning and then, again at the end. Notice the way in which she summarizes and attempts to bring student closure. So this is a teacher seven weeks later. Notice too, that the differences are not statistical differences, significant at the .001 level, these are interocular differences--namely, any reasonable person watching this performance can see the differences immediately. (Videotape was viewed.)

What I want to show you now is the way in which we use the micro-teaching in a teach-reteach situation. The first time the teacher comes in and teaches a lesson of his own choosing, in his own way. Then we may show him some model tapes--show him how the teacher is using the skill effectively. We then have him try teaching it again. Next we train him a bit and critique it, he views his own tape, and then tries again. This process can sometimes go on several times. What I want to show you is how we take the teacher who doesn't interact with students at all, and over a period of about two hours, in a single morning, train him to interact with kids.

Let's look at the specific training on a specific matrical scale. This is what we call a base-line lesson--we just ask them to come in, teach whatever they want to teach, and take whatever perogatives they want to take. Introducing--(Videotape was viewed.)

Interaction with Class

You can see the amount of interaction he had in the classroom was extremely limited. You noticed also how exciting that lesson would be for students; I mean you could hardly wait for the next 45 minutes. Notice, too, that he had the chronic difficulty; he was talking generously about the post-war recovery of Europe as a lovely-five minute topic. After he taught this lesson, we showed him the following model of a teacher interacting with students in a maximum way. In fact, by count, this model teacher interacted 33 times with students in five minutes. By interact, we're talking about when she stops talking and someone else starts talking, and then they stop talking and she starts talking again--that's one interaction. There were 33 of these interactions within five mintues.

The model that we use is also an instructive model in micro-teaching. This is another thing we found; we're much better off if we can identify a skill to model in micro-teaching rather than to run around with the video recorder trying to find it naturally in the class, because in the micro-teaching situation, we can highlight it and construct it to demonstrate what we're trying to demonstrate. It would be very difficult to go out and try to find this concentrated question-answer session from teachers in a classroom. It is real teaching because these students she's teaching have never heard this lesson before; although this particular model is about the seventh take. In other words, she had run through about seven groups of students until we got a model that we were pleased with all of which could be done, in a half day. If you're running around hoping for rain in the classroom, you can go on for weeks trying to find the things you want to find. So, we're very, very big on constructing a model to demonstrate the things we want to demonstrate. (Video tape was viewed.)

We were interested that morning in only one thing; could he interact with students more. We did get him to change his behavior in terms of the way he interacted with students. Again, you don't need a slide rule to see it. You can have different strategies. We were training him in something called questioning skill. We wanted him to use effective questioning. You can either take the strategy to go from zero questions to a few good questions to many good questions, or you can use our strategy which was to go from zero questions to many bad questions to many good questions. Do you see the point? Usually, the reinforcement that you have to give here is not to say "Aha, you asked a bad question." "That wasn't a good question, there's a good question." That's a very difficult reinforcement schedule because really, when he's trying to learn questioning, you're still punishing him because the questions aren't good ones. So, we would rather have the strategy of saying, "Okay, we want you to ask questions," and following the first step of that strategy, we will reinforce him and reward him for every question--good, bad or indifferent. After we get him asking questions and interacting with the class successfully, then we'll go on to the next step and try to refine his questioning technique. In many ways, this is just sheer old conditioning theory. You get the pigeon to turn around a quarter of the way first, then you give him some grain, and after he learns that pretty well, you make him turn half way around. However, we're not stopping with Skinnerian type responses; this is just the beginning. Once we get him asking questions, then we are in the position of going on to the next level and saying, "When and how, what combination, who did you call on?" and all these other kinds of things. These questions aren't relevant until he's asking the questions. So we want to break down the skills of teaching into more discrete parts.

I want to show you another training skill; this one shows, even more, the process of exaggeration in a training situation. Also, it shows a few other things. You always collect a few miscellaneous bits of information in the process, and I want you to notice the beautiful example of what I call the "shot-down" teacher. Here is a teacher who had counted on a lesson plan; namely, that the kids were familar with the section of Reader's Digest known as "It Pays to Increase Your Word Power." She has based her whole lesson on this and with the awful awareness dawning, that the students were not familar with "It Pays to Increase Your Word Power" you see her collapsing into a psychological puddle on the floor and then picking herself up and going on. It's a beautiful example of the "shot-down" teacher. We could use this as a model for that purpose. This wasn't the reason it was collected; it was simply her base-line performance on another technical skill. (Video tape was viewed.)

Use of Silence

In another performance a short time later she is using interaction skills a lot more comfortably. (Video tape was viewed.) She is very comfortable interacting with the kids. The skill of the morning was the use of silence. Now it turns out that teachers--particularly beginning teachers (also experienced teachers--and they've never thought about it much)--don't use silence very constructively. Beginning teachers are very compulsive, they get verbal diarrhea if silence is used in the classroom. You know that silence says, "You're not learning, you're not learning, and I'm not teaching, and we can't tolerate that," so the teacher starts giving hints and "helpfuls"--this and that and the other thing--and the whole thing keeps going as a very heavy verbal barrage. So one of the things that we're trying to help teachers with is to be comfortable with silence. We've adopted a training strategy which we're not at all certain of, but this illustrates another use of micro-teaching, namely, can we exaggerate a skill? Can we let a teacher demonstrate for us that you can teach a whole lesson without ever saying anything? That's an exaggerated use of the skill, and we have a model lesson, a five-minute lesson, where the teacher spends the first 45 seconds or so establishing a verbal context for what the kids are supposed to do and from then on is completely silent. He uses non-verbal cues to conduct a lesson. And the interesting thing about it is that, however obvious it may be to us, it turns out that those kids couldn't tell you at the end of that five-minute lesson whether or not the teacher has spoken. Here we go with the first model. Please excuse the fact that we have the attorney general doing the surgeon general's work--that's all right, we don't care about that. (Video tape was viewed.)

My favorite part of that model is where he stops the student in mid-air; he just stops her and then he thinks awhile; he just completely says, "Wait a minute, I want to think awhile." He thinks awhile and then he starts in again as if nothing had happened. This is a pretty powerful demonstration to show a teacher that you really can control the situation and never say a word. It's very interesting that a lot of people confuse non-verbal communication with inquiry or non-direction. Now, I submit that the class that he was teaching was about as teacher-dominated as you could find anywhere. He was controlling about every single dot and title that went on in that classroom, but he didn't have to use words in order to do it. Once again, we tend to confuse these processes. The teachers see the model and they try to learn to be silent.

I want to show you the next round of Mrs. _______, because it demonstrates the golf-grip phenomenon beautifully; the way she does it, it comes out charades--so help me, it's charades. But she's doing it; she's able to use silence and she becomes increasingly more comfortable with it over a period of time. It turns out that silence is one of the favorite skills that our interns learn; they say that this buys them more comfort per square inch as beginning teachers than any other skill that we teach them during the whole summer. (Video tape was viewed.)

Now again, she wasn't using that very well. As I say, it came out kind of charades; she was really relying on that blackboard as a crutch. That blackboard was really an integral part of her lesson. But it's a start. More importantly, in one morning, she's learning a new skill.

I'd like to underline the fact that micro-teaching isn't just to be used for very dominant teacher skills, we can use micro-teaching for inquiry training. We just had a dissertation completed by John Koran (1967) when he used micro-teaching to see if he could train people to use the scientific method of inquiry better. It isn't just teacher-dominated skills. However, the best developed skills that we have are presentation skills; the reason that we started there is that everybody is always telling teachers to lecture better, but nobody ever tells them how to do it. We know that this is one of the dominant activities of the classroom and so we have selected this dominant activity as one of the places on which to focus our material.

Use of Redundancy

I now want to show you a different kind of modeling procedure and this is what we call a "highlighted model". The models that you've seen so far have been models in context, namely, embedded within a complete five-minute lesson. Here is a modeling procedure where we are modeling the skill of redundancy, namely, the deliberate use of repetition. We feel that teachers don't use this very well. Redundancy is the course of over-learning and we have to say certain kinds of things again and again and again. Tell them what you're going to tell them, tell them and tell them what you've told them. We want to get teachers skilled in the use of redundancy and this is a modeling technique we've developed for that.

TAPE:

> We are concerned today with the use of redundancy as a teaching skill. Redundancy, for purposes in this study, may be defined as varied repetition. Redundancy may include the following forms: repetition in the form of cumulative repetition, distributed repetition, mass repetition, summary, verbal emphasis, visual emphasis or visual highlighting, use of self-analogies, use of metaphors, and use of examples which may be either given by the teacher or solicited from the students. Repetition, itself, may be repeating single items or statements nearly verbatim following their initial presentation. This may occur in the form of cumulative repetition. In this case all prior points are repeated each time a new point is introduced as in the following instance: "Today we're going to discuss four types of government. First will be 'democracy' which, for our purposes today, we will define as government by the people. We consider the individual as the most important person. Democracy. Second, 'anarchy'--the absence of government. Democracy and anarchy. Third, 'oligarchy'--government by the few. So we have democarcy, anarchy, and oligarchy. And fourth, 'totalitarianism' which, for our purposes

today, we will define as government by one person. So the four kinds of government would be democracy, anarchy, oligarchy, and totalitarianism." Now you realize that there are more forms of redundancy--varied repetition or redundancy through verbal emphasis. "Okay now the important thing to remember about limestone is that it is the remains of shells and other parts of living things that settled to the bottom of the ocean." Visual highlighting as opposed to verbal emphasis may include the use of a number of aids to clarify and illustrate as you will now see. "Democracy can be represented by people in all classes. Democracy--rule by people of all classes. Anarchy, we can represent as the absence of government. Oligarchy, we can represent as the rule by an elite few. And totalitarianism will be represented by rule of one single person." This form uses visual highlighting, thus achieving repetition with the use of visual aids.

This is another type of modeling technique in which you excerpt a model for purpose of demonstrating just what you want to demonstrate. Again we find that for certain kinds of skills the non-conventional model seems to be more important, because if you want to illustrate these rather detailed kinds of things embedded in full lesson, they get lost. So you want to pull them out, highlight them, and make them a series of vignettes.

MICRO-TEACHING IN SUPERVISION

We feel that we've been premature in teacher education by-in-large by talking about the professional decisions, talking about grand things, like individualizing instruction--and who can be against individualizing instruction--it's like mother, apple pie and the flag. But that really doesn't tell you anything. All right, we're all in favor of individualizing instruction, now what do we do? You want to motivate your students. Show me a motivated student and how we get him that way. Do you see what I mean? We have these grand and wonderful things that we keep telling teachers but it doesn't lead them anywhere. I want to show you how we trained Mr. Brown, and believe me, we're not using these lessons as examples of anything--I mean, I wish he knew how to pronounce the names of the mountains that he uses and a few things like that. But we're not worried about that; we are focusing only on one thing this morning and that is on his questioning skills. This is another thing that we have learned in the process of our program and that's a new model--a new protocol of supervision.

I'd like to take five minutes out and discuss a new protocol in supervision because I think that its very, very critical to the whole process. Traditionally, supervision goes this way: you go in and visit for an hour, then you write down a long bill of particulars--you know, "Johnnie didn't do this," and "the bulletin board mmm mmm mmm mmmm," etc., then we have a conference, and then we come back next spring. That model of supervision, which is 95% of the supervision in the whole country, violates about every canon of learning that we know. There is an awful lot about learning that we don't know, but there are a few things we do know, and this process of supervision violates every one of them. If you ask supervisors, why don't you get in and supervise more, they will always reply, "Gee you know, we'd like to but we don't have the time." Now if you get the same supervisor alone on a dark night in a remote alley where no one can hear, and then you say, "Why don't you supervise more?" the answer is going to be quite different; the answer will be, "I'm bored stiff, I can't stand going into that classroom and just sitting there." But no supervisor is ever going to admit that publicly because, again, that's like being against mother, apple pie, and the flag. We're completely hung up on the fact that we have a classical model of supervision which says in the purest tradition, "You can't even take notes in the back of the classroom; you're supposed to sit there and just sort of smile faintly and fade into the woodwork." We've mostly violated that and allow supervisors to take notes, but we still say its very important not to interrupt a class. Therefore, you have to be there before the class starts and you can't leave until the class is over and all that sort of nonsense. All of these are beautiful myths but they relate not at all to the process of supervision and constructive change of teacher behavior.

What we propose as a model, as an alternative, is as follows: A supervisor goes in and stays as long as he needs in order to learn what he wants to learn in terms of the thing that he is examining. Typically, this will be a five or ten-minute visit. Typically, the supervisor will not come in at the beginning of the hour nor will he stay until the end of the hour; he will come in at any time during the lesson and he will leave at any time. Again, how much this is going to interrupt the class will depend on what the class is used to. If this is the standard protocol of supervision, it's not going to interrupt the class much to come in, sit down, supervise, and leave.

In eight years, we even found a change in this business about "the classroom is a castle" thing. The first time we went in to make a filmed recording of a teacher it was awful. We were concerned not to disturb the class, so we had the camera running with no film in it for three days to start out with--to let people get used to the idea. The whole school was buzzing. The teacher would say, "Oh, I wouldn't ever let them do that to me, I wouldn't let them do that to me." Our poor intern teacher got more and more excited with all the classroom and faculty-room buzzing, so finally we said, "Well Gloria, what's the matter?" She said, "All the teachers here say that they wouldn't let you do that to them and they think it's terrible the way you're intruding in my classroom." "If you feel that way, Gloria, if you really don't want to, we won't do it." She said, "You mean I have a choice?" We said, "Yes" and she said, "Well then it's okay."

I can remember our original experiments when we used to bring in two of those old Ampex-600 audio tape recorders. We'd come carting those into the classroom and we'd set them up on the teacher's desk, and you would have thought that it was a first-class problem just to make a little audio-tape recording of the class. We had all sorts of trouble. In seven years of our program we've gotten to the point where we can wheel our video tape recorder in during the middle of the lesson, plug it in, make the recording, take it out again --and nobody notices. Literally, nobody notices! The difference is that the use of the video recorder has convinced teachers that they are going to get something out of it. They want to see that video recording, and they don't mind.

The first time around we usually let kids see their part in the recording, minimize the whole process, and nobody minds. In these same hallways where the teachers used to buzz, buzz, buzz, we have teachers who are saying, "Could you bring the recorder by and record a little bit of my class?" The whole atmosphere has changed; people who are still concerned about video recording violating the integrity of the classroom simply don't know what they're talking about. I don't deny the fact that I could find in many classrooms in this land where teachers are going to be uneasy if you bring in a video recorder but we've done this with enough teachers, under enough circumstances, to know that it is simply a lack of information or a poorly organized routine rather than anything that is inherent in the process. We find that teachers welcome this technology and it is not a problem at all. One of the sure ways to get in trouble with the process is to make a big deal and say, "Is it all right if I come into the classroom, do you really mind?" as if they should mind. We put half of the notion into their minds that this is a big deal. Now, we simply say, "We're going to bring the recorder in tomorrow and you might like to mention it to the kids ahead of time." By then it's all over being a big deal. If we make a big deal out of it as supervisors, then the teachers start making a big deal and everything goes up in smoke.

The process of supervision calls for the supervisor to go in, with or without video tape, and spend, usually, five or ten minutes. We don't specify the time to the supervisor. We say, "Stay as long as you need to get the information you want to get." Then too, the important thing is that the supervisor is limited, under pain of death, to supervising on one, or at the most two, aspects of teaching. We've had a terrible time with supervisors who always want to sneak in a little third thing that "doesn't count." We say, "Well if it doesn't count, don't say it." They just can't resist saying something about the bulletin board; they can't resist something about this. No! A maximum of one or two things. Why? Because teachers have difficulty in focusing on more than one or two things at the same time.

Our conferences then are in terms of these one or two things. We ignore everything else; we concentrate on those one or two things in the conference. We may say some nice things, but we don't ever ask the teacher to work on more than the one or two things. As a result of that conference, we arrange with that teacher to come back for another visitation of five or ten minutes to see how well the teacher is able to do with the suggestions we've given, and then follow that with another conference. This becomes the unit of supervision. In other words, our supervisors are never allowed in the classroom unless they come back to find out how well the teacher is able to follow-up on their suggestions. They are not allowed to make the first visit unless the second visit takes place within four days. That's our iron-clad rule, because if you look at the model of learning, first of all, you have to have focus. Secondly, the teacher has to have an opportunity to practice what he's trying to learn. Then a teacher has to have feedback and knowledge of results and an opportunity to demonstrate the next step. You may oftentimes put a third sequence to this, or a fourth, or maybe one of these two things will be commented on for four or five supervisory sessions and the second one will change. Or maybe you won't comment on one for awhile, then come back to it later and comment on it again and give a booster dose.

If you're going to get behavior change, the process of supervision is a very slow process. We find that if you use this process, then you do get behavior change. The teachers can learn to do things differently, but it means that we have to be an awful lot more selective in terms of what we focus on. Thus, over the course of a year, to supervise on a half-dozen or ten different specific things is a lot of supervision. But notice that in this process as we have described it, the whole supervisory process of visit-confer doesn't take any more supervisory time than the old model. And the nonsense about "You have to see the full lesson for context," is a big myth, because you get one context in terms of the whole lesson; you get another context in terms of the end of the one lesson and the beginning of the next lesson. Another important context is the beginning of a unit and the end of that unit. There are lots of contexts in teaching that are completely independent of that self-contained class hour and we've been completely deluding ourselves to think that there's something sacred about going into that classroom and sitting there for an hour and getting bored. Using the protocol described I believe that within a few minutes, depending on what you're looking for, you can get more than enough information to keep a supervisor busy almost indefinitely.

Now, I'd like to show you a supervisory session. This supervisory session is based on the classroom, not on a microteaching lesson, but we find that sometimes supervision can be even more effective when the supervisor wasn't there for the original lesson. In other words, record the lesson and let the supervisor and the teacher look at the lesson together and then work on that. As a result of some of our more recent experimentation, Dr. David Young finished a dissertation (1967) whereby he showed that you could use remote supervision in which the supervisor and the teacher don't even have to be together. The supervisor simply puts his supervisory comments on a second sound track on the same video tape. Dave is going to use this at the University of Maryland next year where they have a number of teacher-education centers that are remote from the University. Tapes will be made there and sent back to the main campus; supervisors will put comments on the tapes and send them back out to be played by the students. This illustrates the process of supervision that we are very concerned with, namely, focusing on one thing. You'll see Dr. Seidman in the film supervising on the use of reinforcement in the classroom, the various techniques of reinforcement. That's the only thing he talks about; he is ignoring everything else but he is getting to the teacher on reinforcement. (Video tape was viewed.)

Again, you notice that he was just being very single-minded in what he was supervising. He was not seeing the whole lesson; he has never seen the lesson being taught. We find, again, sometimes it's better for a supervisor not to see the whole lesson. Because if he does, he knows too much and can't resist the fatal urge to talk about many, many, many different things.

In the use of video tape in supervision, we find two things are necessary; first, you have to teach supervisors that video tape is not a spectator sport. Supervisors are much inclined to sit there and watch the whole tape with students. We find for example, even when we have a 50-minute class, we don't record more than 15 or 20 minutes of the class because we can't get anyone to look at more than that. It just gets too boring. So we make only a 15 or 20-minute recording. Then we have to train the supervisor not to sit there and watch the whole 20 minutes. If the supervisor watches 30 seconds and that gives the adequate cue for what he wants to supervise on, then the video tape has served its purpose. The problem you have when you first start using video tape is that you're so enamored with the video tape that you don't think you're getting your money's worth unless you sit there and watch the whole thing. As soon as you get enough information to work with as a supervisor the video tape has served its purpose. First of all, we have to train them not to watch all of it, not to be over-compulsive about it; and secondly, we have to train them to break in. You notice how Dr. Seidman would say, "You see what you're doing there, see what you're doing there? Now listen to what he (the student) is doing here, let's watch and see how you respond," all the time while the tape's going on. You see, this is what makes it more powerful than the supervisor sitting in the back of the classroom, watching the lesson, and then talking about it later. By watching the video tape together you can interject right then all the way through.

Then the third thing, of course, goes back to what I said earlier: Don't try and supervise on too many dimensions. You know there are hundreds of things that the supervisor could have gotten from that lesson; he was only looking at one thing--what kind of reinforcement was she giving students--and that was the only thing he was interested in. There was no connotation of "everything else was fine." That wasn't the idea. It was just everything else was irrelevant which is very different from having the connotation that everything else is fine. The other thing is that when the supervisor is compelled every time to comment on everything, then the connotation is that everything that you didn't mention is okay. However, when the supervision is focused, there is never any connotation about what's left over and what hasn't been said.

MICRO-TEACHING IN THE PEACE CORPS

I would like to close by giving you a little bit of insight into the use of micro-teaching in our Peace Corps program because this gives you a dramatic instance of how micro-teaching is more real than real teaching.

We were confronted with the problem of training over the past two years some hundred volunteers to go to the Phillipines to teach English as a second language. The one thing that we're a little short on in the United States are native Tagalog-speaking youngsters that we could practice with. To find classrooms for 100 teachers with native Tagalog speakers is quite a chore. However, we were able to find 25 Phillipino youngsters, recent immigrants from the Phillipines, native Tagalog speaking kids we were able to bus down to Stanford every day. These 25 kids, taken four at a time in five-minute lessons, were able to provide very, very realistic experience for Peace Corps volunteers. These were kids for whom learning English as a second language was a real chore, a real task. They were native speakers in the language in which the volunteers were preparing to teach. I thought it would be fun to show you an excerpt of micro-teaching as being more real than the real classroom. (Videotape was viewed.)

CONCLUSION

You see, micro-teaching isn't an orthodox thing; there's no one way to use it. There is no one length for the lesson. Why do we use five-minute lessons? Simply because we found that five-minute lessons are long enough for most specific purposes. We have adopted one rule: when in doubt, use the less complicated--the smaller class, the shorter lesson. We've tried three kids and we've tried five. We think there's a difference between three and four; three isn't complicated enough for the interaction skills. We don't have evidence about that--that's intuitive judgment. We don't notice the same kind of difference between four and five, four and six, or four and seven, so we think that four is probably a minimum number in terms of interaction skills. On the other hand, when we come to training in such things as set induction, sometimes we'll use only one student.

As another part of our micro-clinic we put several intern teachers together, have them plan a series of lessons--12 lessons each 20 minutes long, and they teach this unit to the same students. In other words, the students are trying to learn a body of content over a sequence of lessons so you can still use micro-teaching to study aspects of the context of teaching.

These things I was showing you this morning were concentrating on the skills of teaching rather than on the content or subject matter of teaching. The micro-class format--the longer lessons put together--are designed to deal with the content of teaching. The advantage is that you can construct lessons as you wish for the purposes you wish. They can be longer or shorter, larger or smaller. We would urge you to construct your own models, to construct models that would be appropriate to the subject area you are dealing with, the content and context, and the skills that you feel are appropriate. We've been working, as you know, in vocational education specifically. The examples I have given you this morning were not from vocational education because in our teacher education program, where we developed micro-teaching, we have been working with general liberal arts graduates. However, in some of the in-service applications in our vocational education project we've been working specifically with micro-teaching in the development of various types of performance criteria in vocational education. This we can do because another use of micro-teaching is to allow department teachers to get together to examine the effect of teaching a curriculum a particular way.

Suppose we have a six or seven man department or even a two-man department, or a one-man department, and we're trying to decide how to teach a certain bit of content. One way of using micro-teaching is to get to two or three different sets of three or four kids, see which way you like the best, and depending on which way you like the best, use that for the total group. Given the present classroom situation, we can try one way and then again next year, we can try another way. That's a pretty slow schedule of improvement. If we can anticipate by teaching small groups of students two or three different ways in order to try it out and get information about it, then you can apply that information to the total group almost immediately. You can use this as an in-service device in departmental meetings in which a teacher might volunteer to try out a new technique or examine alternative techniques which the department itself will critique.

There are a number of different applications of micro-teaching. It's not an orthodox thing; we haven't come to the end of the line. We don't know all there is to know about it. Micro-teaching is a very simple device. It's a way of scaling down teaching to gain more control over the teaching situation, to construct it at our convenience and then to elaborate upon it as we wish.

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MICRO-TEACHING

Interest Group Sessions

Charles R. Doty
Patricia Smith
James L. Hoerner, Chairmen[1]
Dwight W. Allen,[2] Consultant

The consultant, Dwight W. Allen, supplemented his general session presentation on micro-teaching by visiting each interest group session and reacting to questions from participants.

Today, attitudes toward using technology in education have greatly changed. Educators realize that technological devices, particularly videotape recording equipment, do not interrupt and upset the normal balance within the class, but actually aid the teaching process. It was found at Stanford that students' behavior improved during the videotaped micro-teaching sessions because the students felt that the teacher was depending upon them. Then, too, the teacher is not disturbed because he is eager to have the advantage of using micro-teaching and the videotape recording to help him improve his teaching technique.

Dr. Allen mentioned to the group that a text on micro-teaching will be printed shortly. In addition, SRA (Science Research Associates, publishers) will publish materials on micro-teaching in February, 1969. Presently, dissertations on videotape-micro-teaching research are available: Xerox copies may be obtained from University Microfilms, Ann Arbor, Michigan. Suggested authors of pertinent dissertations are Orme, Young, Atcheson, Johnson, and Meyer.

In addition to the work being done at Stanford, Dr. Allen also mentioned that Wayne State University has used micro-teaching in business and office education. The University of Illinois uses a system of role playing with videotape playback somewhat similar to micro-teaching.

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[1] Mr. Doty, Miss Smith, and Mr. Hoerner are research associates, The Center for Vocational and Technical Education, The Ohio State University.

[2] Dr. Allen is professor of education, College of Education, Stanford University.

Advantages of the System

1. Teacher behavior can be changed effectively by having the teacher view teaching skills demonstrated by a model film as well as seeing videotaped recordings of oneself.

2. A focus can be kept on one skill of teaching at a time.

3. It is not necessary for the supervisor to observe a whole instructional period.

4. Focus can be made on the teacher behavior, student behavior, or interaction of both.

5. Technology is used for educational purposes but does not/should not rule educators.

6. Micro-teaching operates under safe conditions; student learning is not threatened since the session does not replace regular student classes.

7. Micro-teaching can provide the initial experience in teaching and can lead to an early career choice for persons in college.

8. A micro-teaching recording can provide a model of a particular teaching skill for the trainee to observe.

9. New ideas and methods can be tested within the micro-teaching framework.

10. Micro-teaching sessions can be scheduled at any time of the day, or on Saturday. The teacher can present any subject material while working on a specific teaching skill. He can terminate the lesson at any time and begin again--with a new group of students. He can teach the same lesson repeatedly. Thus, it is a controlled situation.

11. Micro-teaching is an economical use of supervisor's time and seems financially feasible.

12. Professional decision making can come about because a teacher has several teaching skills from which to choose.

13. Micro-teaching would be excellent for teaching specific content skills; each content area must deal with content skills.

Disadvantages of the System

1. Problems exist in identifying a good model.

2. The initial cost of setting up the program or system can be high.

3. There is a need for research in home economics and health occupations to determine specific content skills that could be taught by this medium.

4. Users of micro-teaching must first deal with the process of bringing a change of attitude on the part of those concerned with administration of public schools and supervisors at the state level.

5. There are many technological problems and improvements of equipment needed before the system would be accepted as completely satisfactory in order to convince school systems, state departments, and some colleges and universities to make the initial investment for equipment and a commitment to long-range upkeep.

Value of the System for:

Administration-Micro-teaching is more economical of time and money than regular supervision.

Less staff is needed for supervision because micro-teaching does not require supervisor travel and the teaching sessions observed are short.

The videotaped teaching session may become part of every teacher's placement file.

Supervision-Micro-teaching helps bring about a healthy change of attitude toward the role of the supervisor.

Micro-teaching enables the supervisor and teacher to concentrate on specific problems.

Micro-teaching reduces the boredom of the supervisor.

Teacher Education-Micro-teaching is valuable in both in-service and pre-service education.

Instruction-Laboratory skills may be developed on a one-to-one basis with videotape recording equipment, and it can be a powerful tool in curriculum development where content and educational techniques can be tested quickly.

A TYPEWRITING ANALYZER

Interest Group Session

Annell Lacy,[1] Chairman
Thomas Rausch,[2] Consultant

The consultant described the typewriting analyzer known as DIATYPE, demonstrated how it is used, and responded to questions about cost and applications.

The analyzer is a device that is attached to the paper bail of the typewriter to pull the paper through the typewriter at a constant speed which results in an angular line of type. It comes in both electric and battery operated models which may be used on all models of standard manual and electric typewriters.

The purpose of this device is to diagnose typewriting by analyzing a variable angular line of type. Vertical spacing between letters in the angular typing line exposes varying time lapses which result from incorrect technique and typing irregularities. The analyzer utilizes the principle of non-uniform spacing between letters to diagnose typewriting irregularities such as poor rhythm, hesitation on difficult letters, figures and symbols, lack of concentration, slow carriage return, and other weaknesses. It also provides a method of measuring the student's potential typing speed.

Teacher training institutions may be interested in informing their students in business education about this device which appeared on the market in the fall of 1967. Classroom teachers need approximately one analyzer (at a cost of $89 per unit) for every four students in order to effectively use it both as an indicator of potential typing speed and incorrect typing techniques.

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[1] Miss Lacy is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Rausch is sales representative, Scientific Advances, Inc., Columbus, Ohio

STUDENT CARRELS AND AN AUDIO-INSTRUCTIONAL SYSTEM

Interest Group Session

Kenneth Hoffman,[1] Chairman
Robert Bratton[2] Consultant
Earl Posey,[3] Consultant

The consultant described the use of recorded materials for individual instruction and the relationship of recorded individual instruction to group instruction. He stressed the individual's need for active involvement in the learning act. Mr. Bratton demonstrated the capabilities of individual study carrels and the Con-trol-Visor System as a supervising and group or individual programmed technique.

The system consists of free-standing student carrels with headphones, a recorder, and controls wired to a teacher's control panel. The Con-trol-Visor System utilizes durable magnetic recording discs, but the carrels and the system can be designed to accommodate tape recorders.

Advantages of the System

1. The local school can use its own tapes or tape recorders in this system.
2. Prepared tapes can be purchased for a variety of uses.
3. Each student has a set of earphones and can communicate directly with the teacher without disturbing the other students.
4. The system is flexible in that it can be switched from group to individual instruction and back instantly.

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[1] Mr. Hoffman is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Bratton is president, Bratton Corporation, Columbus, Ohio.

[3] Mr. Posey is a representative, Bratton Corporation, Columbus, Ohio.

5. Students can listen to themselves in instant playback.

6. All students can read at once and the teacher can tune-in to any student for evaluation or correction

7. The system can be expanded by adding carrel stations; access to each station is controlled through the teacher's control panel.

8. The system can use durable magnetic recording discs or tape recordings for student or teacher-made tapes or for pre-packaged material.

9. The system can be expanded to include more functions by additions to the controls.

Disadvantages of the System

It can be complex for lower grade or lower ability students to operate. However, most students are able to operate the equipment as it operates similar to a phonograph.

Value of the System

The major use appears to be in the instructional area for individualizing group and related instruction or in the development of remedial systems such as reading.

Suggested Application of the System

The system is being used extensively in basic skills programs such as by the Columbus Manpower Development and Training facility in its learning resource center. The use in vocational programs on the secondary level is not as yet widespread, although the potential for this type of system is great.

Facilities Implications of the System

Since the individual stations are all connected through the control panel and the control panel is portable, special rooms or facilties are not needed for this medium.

C. MEDIA FOR LARGE GROUP INSTRUCTION

LOW COST OVERHEAD TRANSPARENCY PRODUCTION

Arthur K. Jensen[1]

I. Statement of the Problem

Early in the present decade, leaders in vocational education in South Carolina recognized that with the stupendous advancement in technology, vocational education programs in the state were in tremendous need of new and up-to-date teaching materials. The question of how to meet the need became the question of the day.

Not only was there a need because of technological advance, but there was also a need in terms of conservation of human resources. Industry was moving into the state at an unprecedented rate. The labor supply was being rapidly exhausted, particularly in areas requiring skilled employees. At the same time the drop-out rate in secondary schools had not declined as would be desired. The percentage of those failing the Selective Service Mental Test was embarrassingly high. Teachers were in short supply and in many cases overloaded with teaching assignments.

Several questions came to the forefront:

1. How do we keep youth in school?
2. How do we keep the programs of vocational education up-to-date in subject matter?
3. How do we help the already overloaded teacher keep up with technological advance and improved teaching procedures?
4. What service could and should the State Division of Vocational Education and other educational services within the state be to local programs?

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[1] Dr. Jensen is director, Vocational Education Media Center, Clemson University.

II. Development of the Overhead Transparency Project

About the same time, research conducted by the Socony-Vacuum Oil Company was reviewed. They found that:

1% of what is learned is from the sense of taste.
1 1/2% of what is learned is from the sense of touch.
3 1/2% of what is learned is from the sense of smell.
11% of what is learned is from the sense of hearing.
83% of what is learned is from the sense of sight.

They also concluded that we retain:

20% of what we learned through hearing.
30% of what we learned through sight.
50% of what we learned through a combination of hearing and seeing.

Vocational educators in South Carolina concluded that any effort extended must include audio-visual aids. One of the tools that was highly rated was the overhead projector. It could be used in an undarkened classroom. The instructor did not have to turn his back to the class. Materials could be prepared in advance and easily filed for future use. The projected image had excellent visability for the entire class. Any procedure adapted ~~to~~ the chalkboard could be adapted to the projector. Many procedures not adapted to the chalkboard could be presented by means of the overhead projector.

By the same token there were real problems. The main problem was the high cost of transparencies. Local and state budgets could not absorb the cost. The second big problem was lack of reproduction equipment on the local level. Third, the teachers just did not have the time or wherewithal to prepare the volumes of such material needed.

Quite by accident a member of the Agricultural Education Department of Clemson University observed the use of plastic in research being conducted by the Poultry Department of the same university. This plastic had many of the same characteristics of the Thermofax 125 transparency plastic. It was also possible to produce a transparency with this plastic by passing it through a Thermofax Secretary copying machine. This plastic could be purchased for two cents a sheet, whereas Thermofax 125 retailed at twenty-six cents a sheet. The user would still have to prepare the original artwork and have the copy machine available.

Upon examining a plastic peanut bag the same individual reasoned, why not print on plastic?

Commercial firms do. Large commercial firms printing on plastic were contacted. The volume requested was not sufficient. Small printers said it was impossible to do.

In the spring of 1966 the Agricultural Education Department of Clemson University was awarded a U.S.O.E. grant.[2] The objectives of the grant were:

1. To develop as a pilot approach effective teaching materials, including a set of 30 to 40 overhead transparencies, on power transmission principles to be used in the training of students enrolled in off-farm occupation courses in agricultural mechanics;

2. During the development of the above materials, to demonstrate and perfect procedures for the reproduction of overhead transparencies by special offset printing techniques;

3. To explain the feasibility of application of the insights gained in developing objectives 1 and 2 to the development of a Southern Regional Curricular Materials Developmental Center for Vocational Education.

III. Procedure Developed for Printing Overhead Transparencies by the Offset Printing Process

A. After considerable research in adapting offset printing techniques to the production of overhead transparencies on plastic, the following standards emerged for the South Carolina venture:

    1. The plastic used would be a low cost plastic. The .003 mm. Trycite cut into 8 1/2" x 11" sheets was selected. It cost about one cent a sheet when purchased in volume. It was not the most superior plastic available. It could be damaged by tearing or wrinkling. However, if used properly and stored properly, a transparency printed on it could be used over and over again. Teachers were made aware of its shortcomings and told how to handle the material. To date they have accepted this as being very satisfactory.

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[2] U. S. Office of Education Grant, Project No. 6-8320, A. K. Jensen, Investigator.

2. The end product would be a ready to use transparency. The image would be printed by the use of standard offset printing equipment usually found in or available to most state departments of vocational education. Only slight deviations from accepted offset printing processes would be considered desirable.

3. The materials would be handled mechanically to reduce costs and to increase the speed of operation. A sorter was added to the offset press so that transparencies could be assembled as they were printed. This greatly reduced labor costs. It is believed that this also assisted in preventing offset.

4. Transparencies would not be framed. The cost of the frame proved to be more than the cost of the transparency. It also required greater storage space. The framing would have to be accomplished manually and would have increased costs considerably. Instead, the transparencies would be assembled in unit sets and placed in a file folder ready for filing.

5. The teacher would be asked to wash the transparencies he received to remove an unsightly dust used in the printing process. This washing would be simple. It would be accomplished by wiping the transparency with a soft cloth dampened with cold water. Either paper towels or dry cloths would be used to dry the transparency.

B. The modifications found to be essential on the standard 1250 Multigraph offset press used in the research were as follows:

1. Static electricity in the plastic caused a great deal of difficulty in feeding through the press. Two Curastat model SE 104 static electricity eliminators were added to the press. One was located just above the tape guide. The second was attached above and to the front of the paper receiver.

2. A good duster was added to the press. The dust was found essential in preventing offset.

3. Infrared heat lamps were added to hasten drying. At the present time experimental work is under way using tubular quartz infrared lamps. These appear to be most desirable, although they must be wired to the vacuum feeder switch so that they shut off when the vacuum feeder is cut off.

4. A Multigraph model 671 sorter was added to assist the drying process and to make mechanical assembly possible.

C. Printing adaptations and techniques found essential in the transparency printing procedure

1. The plastic often contained so much static electricity that the sheets adhered to one another as if glued together. To break this static electricity, the plastic is fanned from all four sides prior to placement in the paper magazine. It is never left in the magazine overnight without being refanned.

2. The plastic is tempered to the same conditions under which the offset press is operated. Progress to date indicates that an air-conditioned printing and storage room is most desirable in controlling the efficient operation of this process.

3. The fountain solution proven most effective to date was one ounce of Multigraph Fountain Etch and one ounce of 8° Baume Gum Arabic to one gallon of distilled water. This was mixed and stored in a sealed container. However, it was found that one had to change the solution in the fountain of the press daily. This solution caused rapid drying of the inks to the rollers, thus the operator had to exercise extreme care in cleaning rollers, deglazing rollers more frequently than usual, and in cleaning of plates and blankets. The solution is a professional type which requires that the operator develop professional operational techniques.

4. Standard Repelex fountain solutions were used to clean the plates during the printing process.

5. Special inks have been and are still being designed for this process. Numerous inks have been tried. To date the most superior black ink tested has been Multilith ML Special Black MLPD 310-2. Colored inks that are transparent are being tested continuously. The researchers will share information gathered on colored inks thus far, but feel further testing is necessary before making any definite recommendations. Further research in the entire ink area will undoubtedly produce better inks in the future.

6. To date only aluminum sensitized plates have proven satisfactory. The development of new inks may change this situation.

7. If the sorter is not used, printed transparencies must not be piled more than 100 sheets high, less if heavier plastic is used. The research has indicated that it is desirable to store printed material in folders that are placed on edge for several days before they are exposed to considerable handling. They should not be laid on top of each other as offset can occur as a result of the weight.

8. The speed of operation of the Multigraph press appears to be most optimum at about 6,000 sheets per hour.

9. Slip sheeting has been used in a number of cases. The actual value to the process has not been definitely determined to date. It undoubtedly prevents some offset. It also removes a bit of ink from the printed product. Teachers indicate they like the use of slip sheets because they can view the completed product without removing it from the folder and placing it against a light background.

10. The offset press operator appears to be the key to the process. The operator must be familiar with all of the fine mechanical operations of the offset press. He must also be willing to learn. He must watch the machine at all times. Plastic jams in the machine are much more frequent than paper jams. Printing on plastic is undoubtedly much more complex than printing on paper. Operator patience is essential.

11. Should the plastic adhere to the blanket, cleaning the blanket and dusting it with a standard blanket dust usually corrects the difficulty. The use of blanket dust when the machine was not in operation was found most important.

D. Cost estimates to date are based on the production of 300 copies of each transparency

1. Single color transparencies have an approximate cost breakdown in the South Carolina research as follows:

Plastic....................................	.01
Negatives, plates, ink, etc................	.01
Artwork - using student labor and simple line drawings (varies with transparency)...	.01
Machine operation..........................	.01-.02
	$.04-.05* per transparency

*Machine depreciation is as yet unknown, but should be recognized. Other costs, such as labor and printing supplies are rising at the present time. This could change the total cost to some degree. Such costs as rental of space for the operation utilities, and janitorial services have not been included.

2. Multiple color transparencies will cost more. Accurate figures are not as yet available. Initial indications are that each added color will add about 4-5 cents per transparency.

3. Half-tones appear to be possible. More research is essential before procedures for their production can be outlined in detail.

IV. Development of the Vocational Education Media Center to Incorporate the Production of Overhead Transparencies

During the fiscal year 1966-67 the development of a materials laboratory was initiated at Clemson University on the contract basis with the South Carolina Division of Vocational Education. The development was to create an effective materials laboratory by July 1, 1967. The laboratory was finally designated as the Vocational Education Media Center.

The Media Center is available to all of the vocational services. It has multiple use and purpose:

1. It is designed to be a unit capable of the production of all phases of media as the need arises.

2. It is designed to have a staff of materials development specialists, an artist, a staff of secretarial help, and a staff of printing technicians capable of reproducing both transparencies and all other forms of printed materials.

3. The unit is designed to be used by Clemson University as a training center for Trades and Industrial teachers in the area of graphic arts.

4. The unit will coordinate its activities with the total educational programs of each of the vocational services.

5. The unit will have access to the production of educational television through the South Carolina ETV network.

6. The unit is completely financed by the Division of Vocational Education.

V. Summary

Through modification and adaptation of the offset printing process, the Division of Vocational Education of the State of South Carolina is now in a position to provide low cost completed overhead transparencies to all vocational teachers of the state. As a result of the printing of overhead transparencies by the offset process, the Media Center is also equipped to produce what is believed to be all essential types of printed material. The Center, upon completion of employment of its materials development staff, will be able to produce materials, the quality of which is limited only by the creativity of those responsible for the Center's operation and development.

MEDIA FOR LARGE GROUP INSTRUCTION IN CHEMISTRY

W. T. Lippincott[1] and W. R. Barnard[2]

College and university chemistry teachers, almost overwhelmed by the problems created by the knowledge explosion (the total volume of chemical information doubles every seven and one-half years), and by the increasing numbers of students enrolled in their courses, are looking more toward audio-visual techniques to supplement and to intensify their teaching effort. Old and often well-founded suspicions of these techniques, such as those aroused when some schools presented entire introductory courses on television, gradually are giving way to the realization that certain aspects of chemistry instruction might better be handled with the aid of media. Such useful media could be short, to the point, films for individual student viewing, television tapes which can bring into the classroom important complex instruments essential in chemical research, but heretofore unseen by all but a few students and computer-assisted instruction programs which make possible a student-teacher dialogue via a computer.

The Advisory Council on College Chemistry, through its Teaching Aids Committee, has done much to stimulate the use of newer audio-visual techniques in chemistry instruction. This group has sponsored the development of film loops, television tapes, and computer-assisted instruction programs, and has demonstrated some of these at three national meetings of the American Chemical Society and at numerous regional meetings of chemistry teachers. In addition, it has prepared and distributed a 45-page booklet, "Modern Teaching Aids for College Chemistry" (1966), which summarizes the present state of hardware and software in films, portable TV systems, and computer-assisted instruction. The Advisory Council also has prepared a newsletter (1967), which gives brief descriptions of innovations involving audio-visual media being made in chemistry departments at 11 colleges and universities. The following sections are capsulated accounts of some of the activities of the Advisory Council's Teaching Aids Committee and certain of the innovations these activities have helped spawn.

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PORTABLE TV RECORDING SYSTEMS

The advent of relatively inexpensive ($1,500 - $5,000), portable, instructor-operated television tape-recording and play-back systems, has made it possible for instructors to prepare their own tapes only a short time before class if necessary, and to show their students items that might be essential to student understanding but otherwise, very difficult to present advantageously. Such items might include dangerous experiments, inaccessible instruments, intricate laboratory techniques. By employing close-up or zoom lenses, making judicious use of the TV camera, and taking advantage of the slow-motion and stop-action features of the video tape recorder, it is possible to present sequences such as the changes taking place in a capillary tube, the read-out on an instrument--enlarged so that every student can take data from his seat--the mechanical or optical operation of instruments--enlarged and in slow-motion. More elaborate TV equipment can be used to prepare tapes which show two pictures on the screen at the same time. Usually these pictures are of the same phenomena, one being a shot of the apparatus and the visual changes occurring there, the other being a view of the instrument read-out, giving a quantitative measure of the intensity of the change. Following is a brief description of a tape in which split screen techniques were employed.

The tape shows an acid-base titration in progress and also illustrates a use of TV tape in instruction. The left-hand portion of the screen is a view of the apparatus. The right-hand side is a close-up showing both the digital pH meter which gives the pH of the solution at any time, and the emerging storage-ocilloscope plot of the pH of the solution as a function of time. By viewing this tape a student should be able to bring together in his mind the physical aspects of a titration with the simultaneously emerging titration curve, the same kind of titration curve he has seen in textbooks. In addition, by using the stop-action feature of the tape recorder, each student can take data from his seat that will enable him to calculate the ionization constant(s) for the acid being titrated.

Table 1 describes a few tapes that have been made by chemistry instructors. It should be emphasized that the hardware now available makes it possible for instructors to make their own tapes without assistance from professional TV personnel. Any instructor can make good tapes with a little practice.

TABLE 1. SOME VIDEO TAPES FOR CHEMISTRY INSTRUCTION

Title	Length	Authors
Analytical weighing techniques and use of the single pan balance	17 min.	Richard Yingling, Robert Barnard Ohio State Univ.
Acid-base reactions	5 min.	Robert Gidden Ohio State Univ.
Mass Spectrometer (time of flight)	5 min.	Robert Barnard Ohio State Univ.
Infrared Spectrometry (Beckman IR-4)	12 min.	Rod O'Connor Montana State Univ.
Using the McCloud Gauge	2 min.	W.T. Lippincott Ohio State Univ.
Nuclear Magnetic Resonance	15 min.	Rod O'Connor Graham Baker Montana State Univ.
Micro Melting Points	7 min.	Rod O'Connor Montana State Univ.
Measuring X-ray patterns	3 min.	W. T. Lippincott Ohio State Univ.
The Isoteniscope	15 min.	E. Haenish Wabash College
Measuring freezing point depressions using the Beckmann Thermometer	6 min.	Robert Barnard Ohio State Univ.
Measuring spectral lines with the Bunsen Spectroscope	7 min.	W. B. Cook W. T. Lippincott Advisory Council on College Chemistry

DISCRIPTIONS OF SOME INSTRUCTOR-PREPARED TV TAPES FOR CHEMISTRY INSTRUCTION

Several schools have installed large screen TV systems in their chemistry auditoriums. At The Ohio State University, a camera on the lecture table is used to transmit live demonstrations or objects such as molecular models to the 12' X 9' screen located at the front of the classroom. With this system it is possible for an instructor to hold in his hand, before the camera, an object three inches or so in diameter and to have the image of the object appear 10-12 feet wide on the screen. Thermometers or timers on the lecture table thus projected are read easily by all students in the 320 seat auditorium. TV tapes of the type described above can be shown on the screen.

An interesting experiment in laboratory instruction involving the new TV hardware now is underway at Ohio State. Approximately 3,500 general chemistry students receive pre-laboratory instruction each week via a closed-circuit TV system. The system consists of a studio equipped with the capability of transmitting a TV picture live, from a TV tape or from a film. Each of the 14 laboratories being served by the system contains two monitors to receive the signal. Three different programs can be telecast simultaneously.

During the summer of 1967 a series of pre-laboratory presentations were put on color film. These presentations instruct the student in such techniques as: how to use the analytical balance; the barometer; the spectroscope; or in the proper way to keep a laboratory notebook, to make a quantitative transfer, or to titrate. The films are made as if the camera were looking over the student's shoulder as he does his laboratory work. Only the hands of the operator manipulating the equipment in question appear on the film. Animation is used to illustrate such things as how an instrument works, or the theoretical model behind the phenomenon being studied. These films are being telecast in black and white to the students in their laboratories just prior to their beginning the experiment in question.

After the regularly scheduled laboratory film is shown, students can call for and see a film shown previously. For example, the film on how to use the analytical balance shown during the first laboratory period was reshown repeatedly at student request during the second laboratory period.

Instructors desiring to give live prelab or postlab presentations can do this either from the studio or by a camera which can be moved into one laboratory where the interaction of the instructor with the students can be televised to the neighboring laboratories. Such presentations make more effective use of the senior staff member or the master teacher than has been possible in the past. They also make use of the close-up and stop-action capabilities of TV to bring out more subtle or less easily shown points.

This laboratory TV system has made it possible to use undergraduate students of high scholastic standing to assist with laboratory instruction. At present, 92 undergraduate assistants and 50 graduate teaching assistants are used in the general chemistry laboratory instruction at Ohio State. While the undergraduates are closely supervised by graduate students and faculty, their enthusiasm and dedication as teachers, when coupled with the improved pre-laboratory instruction provided by the TV system, has markedly upgraded laboratory instruction.

One final application of television in undergraduate instruction might be mentioned. This is the "blackboard-by-wire" technique which enables a lecturer to speak and to write in one location, while his voice is amplified and his writing projected to a large screen for a remote audience to hear and to see. Either TV or overhead projection is used to project the image of the writing. In April, 1967, ten general chemistry lectures were transmitted from a hotel room in Miami, Florida (where instructors were attending an American Chemical Society meeting) to the chemistry auditorium in Columbus. No major difficulties were experienced in the transmission, except in one case when a radio station briefly interfered with the signal. Both instructors and students were pleased with the presentations. Such techniques, while important in certain special situations, would appear to have limited applicability at present.

NEW USES FOR FILMS

Many college teachers have used filmed presentations only sparingly in their courses in the past. There are many reasons for this, including the difficulty of setting up the projection equipment and the fact that while most films contain valuable sections, much of the average twenty minute film is not pertinent to the presentation the instructor wishes to make. In addition, students frequently need to see a film more than once to grasp its major points. Repeated showings during class time are considered inconvenient at best by many instructors.

In considering these difficulties and having examined the new cartridge-loading 8 mm projectors available from Technicolor and Fairchild (1966), the Advisory Council Teaching Aids Committee in the summer of 1966 initiated a series of projects designed to produce short experimental film loops for use in chemistry instruction. These were to serve three general purposes: a) to present a single chemical concept such as the crystal structures of metals for use in lectures or for individual student viewing; b) to illustrate the operation of an instrument; the film to be placed in a projector which in turn is placed beside the instrument so students could view the film before using the instrument; and c) to demonstrate laboratory techniques such as titration on thin-layer chromatography. The committee felt that if the important features of the film maker's art--close-ups, color, animation, stop-action, slow-motion--were wisely used in the experimental films and if they were kept short so teachers could supply their own narration, then films of the three categories listed above might prove useful to classroom teachers. In addition, the committee anticipated that most teachers would welcome short films on instrumentation and laboratory techniques since this would decrease the amount of time an instructor would spend repeating the same instructions. The committee also hoped that some instructors would make their own films.

Film projects sponsored by the Advisory Council Teaching Aids Committee are:

> The Oregon State project under Professor Wendell Slabaugh. This group has prepared a series of about thirty film loops in all three categories for use in Technicolor 8mm or Super 8mm cartridge loading projectors. While he was assisted by other chemistry teachers in preparing many of the films, Professor Slabaugh personally filmed and edited each tape. Titles of some films from this project are: "Atomic and Bonding Orbitals;" "Crystal Structure of Metals;" "Titration;" "Use of the Single Pan Balance;" "Introduction to Infrared Spectrometry;" and "Polymer Science, I, II, III, IV." Many of these films are available from L. B. Educational Films, Corvallis, Oregon.
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> The Harvey Mudd project under Professor J. Arthur Campbell. This group made about twenty 8mm film loops by extracting critical footage from existing CHEM Study films. Titles of some films made in this way are: "A Copper-Silver Electrochemical Cell;" "Alkali Metal Reactions with Chlorine and with Water;" "A Silver-Hydrogen Electrochemical Cell;" "An Electrochemical Cell -- Animated Mechanism;" "Molecular Vibration, Using Models;" and "Effusion of Gases." These films will be available from commercial sources soon.
>
> The University of Illinois-Chicago Circle project. Professor Sam Schrage prepared about ten 8mm film loops on properties of metals by extracting footage from existing films.
>
> The Kent State University project. Professor Rod O'Connor has prepared about ten Super 8mm film loops

on introductory laboratory techniques.

The Computer-Animated Film project. This activity is designed to determine the feasibility of producing useful chemistry films from motion pictures generated on a cathode ray tube by a computer. These films are made in the following way. The computer is given instructions to display on a cathode ray tube, a model of the chemical system under consideration. (This could be a model of a molecule, for example.) The equations governing the behavior of the chemical system (such as the molecular vibration), also are fed into the computer. Then the computer is directed to move the model displayed on the cathode tube in accordance with the equations of motion. The resulting motion picture is photographed with a movie camera and made into a film.

The computer-animated film project is located at three centers. At the MIT Education Research Center, Dr. C. E. Rodriguez is preparing films on topics such as the nature of van der Waals interactions and models of reactions in progress. At the U. S. Air Force Academy, Dr. Jack Penick is preparing programs that will provide films on molecular motions in molecules of benzene size or smaller. At the University of Detroit, Dr. Edgar Bertaut is preparing films which simulate the behavior of gases so students will gain better insight into the kinetic theory of gases.

In an effort to evaluate the films prepared by these projects and to stimulate use of films by chemistry instructors, the Advisory Council has prepared a series of kits containing sixteen film loops and a projector. These kits are available for viewing by chemistry departments on request. The kit must be returned after 10 days with an evaluation of the films.

COMPUTER-ASSISTED INSTRUCTION

Similar in many ways to programmed instruction, computer-assisted instruction is a technique whereby an instructor programs the computer so that it can enter into a Socratic dialogue with a student or students. In the actual dialogue the student sits at a computer terminal and, in most cases, types a message to the computer. The computer responds with a typed statement to which the student is expected to reply. This continues for the length of the program.

To illustrate the technique, we describe a short segment of the dialogue between a hypothetical chemistry student and a computer.

Student: (typed message) I wish to enter into a dialogue on the determination of the equivalent weight of an unknown acid.

Computer: (typed response) Very well, you have unknown number 21348, what do you wish to do with it?

Student: Dissolve it in water.

Computer: Don't you think it would be a good idea to weigh out a sample first?

Student: Yes. Weigh out about a one-half gram sample.

Computer: The sample weighs 0.5324 grams. Now what?

Student: Dissolve it in water.

Computer: How much water?

etc.

In this example, the dialogue continues until the student has obtained enough data to plot a titration curve and to determine the equivalent weight of the unknown acid assigned to him. While this particular exercise is probably better done as an experiment by the student working in the laboratory than via computer-assisted instruction, it illustrates how an instructor can write a program that will lead many students through a learning sequence.

The pioneering work on the use of computer-assisted instruction in chemistry is being done at the University of Texas under the directon of Dr. J. J. Lagowski. During the summer of 1967, Lagowski directed an Advisory Council-sponsored conference to acquaint chemistry teachers with CAI techniques. Participants at the conference learned to use two programming languages--Coursewriter I and APL (a programming language). Each participant developed a programmed sequence on a topic such as balancing equations, the gas laws, organic reactions, or the use of the chemical literature. After these programs have been tested, some will be made available to teachers requesting them for use with students.

At present, CAI has limited use for teaching large numbers of students because even the largest computers can handle no more than about one hundred students simultaneously ---and this at considerable expense. However, the technique is a powerful one and probably will become an important part of college instruction programs in the future.

MODIFICATION OF CLASSROOMS

The variety of modifications of classrooms and lecture halls now being tried or planned is difficult to imagine. We shall summarize a number of these, giving in each case a one sentence description to suggest a particularly outstanding feature. Overhead projectors, already widely used for enlarging demonstrations, are being designed so their images can be projected on a series of screens across the front of the room, thereby eliminating chalkboards. Digital read-out-devices like small basketball scoreboards are being installed in science lecture halls so that measurements of temperature, pressure, pH, electromotive force, etc. can be made during a lecture experiment and displayed instantaneously so students can take the data and use it in discovering relationships. A 16mm movie projector has been modified so that the instructor, holding a push-button control in his hand, can direct the projector to show one or several short film sequences, repeating a sequence if desirable; this makes it possible to insert very short, pertinent film passages into lectures just when they can have the greatest impact. Student response systems give each student a five position switch at his seat with which he may respond in any of several ways to the instructor's queries; responses are collected on a read-out at the instructor's desk. A computer terminal is being developed and will be placed at the front of the classroom and arranged so the responses from the computer can be displayed on a large screen; the instructor can call for any of over 2,000 displays from the computer and receive his request in seconds.

Student study carrels using audio-tutorial systems such as those developed by Professor S. N. Postlethwait at Purdue, are being used in ever widening applications. Dial-access systems which permit a student in his dormitory or in a learning center to dial a lesson which comes to him via audio or video receivers are in operation at several large schools. Every day we learn of new applications of audio-visual hardware and new innovations in instructional techniques.

Chemistry, like all other academic disciplines, is facing its greatest challenge in being required to increase significantly both the total amount of knowledge the student must carry in his mind and the flexibility with which he must be able to use this knowledge. To be successful, chemistry teachers will have to use every intellectual and technological device available to them. While the teaching aids described here are likely to be of great assistance, they rely entirely on the intelligence and the ingenuity of the teacher for their effectiveness. There is still no substitute for the teacher who cares.

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EDUCATIONAL MEDIA HARDWARE FOR LARGE GROUP INSTRUCTION

W. Robert Barnard[1]

The goal of the project we have in the Chemistry Department at The Ohio State University is to prepare a series of simple inexpensive devices which can be prepared by teachers, or at least whose construction can be directly supervised by teachers. This work has been developed in three areas: 1) devices for the overhead projectors; 2) inexpensive motion picture film; and 3) classroom-oriented television presentations.

The devices that we are showing today were built specifically for the use of our teachers here in the Chemistry Department. The devices for the overhead projector were largely inspired by the work of Dr. Hubert Alyea at Princeton University and deal with the 5 in. by 5 in. overhead projector employing the "TOPS" concept. This is a device which holds 5 inch plastic cells. The cells can be divided into one, two, three or more divisions depending on the number of solutions an instructor may want to project at one time. The cells are built on a modular basis so that you can construct these in a few minutes before class, if you like. Here we have some 5 in. by 5 in. squares of 1/8 in. clear plexiglass which comprise the faces of the cells. The sides, bottoms, and dividers of the cells are 1/2 in. black plexiglass. Because of the number of possible combinations, TOPS devices make dandy student projects. The students can be given a problem or assignment and construct their cells for the teacher--you can come up with some rather ingenious devices this way. (Mr. Barnard demonstrated a gas generator and a three-divided cell to show how the modular components were assembled and to show a number of combinations of the cells.) This device is particularly useful because colors, bubbles, and intimate portions of the reactions are visible to the students much better, in many cases, than if these students were to hold the test tube themselves. This is because of the bright light and magnification that we can get through the overhead projector.

We have encouraged teachers to prepare their own finished transparencies. We like to furnish them with a master and suggest that they make their own modifications to the master; check and change terminology and so forth before printing, using any number of the copy processes--depending mostly on whether color is important. When color is important, we still feel that the diazo type of process gives the highest resolution and is one of the most flexible mediums with which to work. We have devised an inexpensive copy machine which can be constructed from a plywood box and several black lightbulbs with a timer enclosed into a reflective housing. This is the type of copy machine we think should be on the desk of every secretary in the school. With this, a few minutes before class, an instructor could ask his secretary to prepare a transparency. This type of production, done in close cooperation with the user and the people preparing the transparency, makes for maximum flexibility and use of the device. This kit sells for about 15 dollars; the plans are available from us if you are interested in building this device.

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[1] Mr. Barnard is a teaching associate in the Chemistry Department, The Ohio State University.

I will now demonstrate making a transparency using a form of the diazo process which has been developed by the Addressograph-Multigraph Company. In this process, all of the diazo coloring elements are contained in aerosal cans and the combining reactants for these dye-colors are contained in a single sheet of film. The film is exposed to an opaque master drawn on a translucent background--as in any conventional transparency preparation--and after the film has been exposed to ultra-violet light through the master, you simply rub on, with a cotton swab, the appropriate dye-colors from the aerosal cans. This has been a very useful procedure where you have colored lines or colored words or some element or symbol that you want to bring out. This process has not been particularly satisfactory where we have large areas to be shaded or colored. I think the more traditional ways of preparing transparencies using colored sheets or diazo materials produce a higher quality picture, but for quick transparencies with lots of color and higher resolution, this method certainly deserves some consideration. The total investment for making transparencies with this type process would be 15 to 20 dollars for the copy machine and about 25 cents per transparency. The cost of the TOPS devices averages about 50 cents per cell. The instructions for making the TOPS cells have been combined into a reprint available from The Journal of Chemical Education, Easton, Pennsylvania, entitled "TOPS." Dr. Alyea has gone to the trouble of preparing a template which can be torn from this reprint, glued onto a sheet of plexiglass, and a school shop could cut out all the basic materials to prepare 12 basic cells. These can be used to perform about 2,000 experiments in general chemistry or general science at present.

Another area which may be of interest to your profession is the capability for putting motion into a 35mm or 10 in. by 10 in. slide. For example, trying to demonstrate the bending and stressing modes of the water to the students and trying to give them any idea of what we think they should be looking for, you realize, is rather tricky. But it's possible with a single slide (demonstration) in combination with a spinning polarizer to give an illusion of motion. A black and white slide such as this costs less than a dollar. The spinning polarizer is know as the Kodak motion adapter and can be adapted to any standard 35mm slide projector. The same technique can be employed with the 10 in. by 10 in. overhead projector. A firm which makes the spinning polarizer and the animation materials for this type of presentation is Technical Animations, Incorporated, Port Washington, Long Island, New York. They have a starter kit, some people may wish to examine, which has materials in it to give linear motion, blinking, rotation effect, etc. This is a very simple process to employ; it can be added to any overhead projection transparency--you can judge its effectiveness for yourself. The 35mm motion slides must be prepared by Technical Animations, and I would suggest that you write them if you have a particular concept you would like to have developed using the motion slides.

Since closed-circuit television is used in the teaching of general chemistry, we have a large screen television projector set up in our auditorium that projects a 12 ft. by 14 ft. image on the classroom wall over the instructor's head. The projector is a rather large device as you can see from this slide. (Slide was viewed.) It was necessary for us to buy a large projector to get the necessary light output so that the television image could be viewed in a well-lighted room. We have about 32 foot candles of light on the students' writing area while we project the television image. A self-contained television camera is mounted on the lecture demonstration bench and is connected to the projector. Both units are entirely under the control of the instructor. He simply has to turn on an "on" button; all the equipment is pre-focused and there are no other adjustments for the instructor to concern himself with, except perhaps a minor focusing adjustment on the camera which is a mechanical adjustment. We had developed for us several new pieces of hardware to use with the TV projector and the 1 inch video tape recorders. One of these devices is a special effects generator which allows us to combine the pictures from two cameras into a single TV image. We have found this to be particularly useful when we wish to focus one camera on an extreme close-up of a meter reading or a thermometer and the other camera at the overall reaction or piece of apparatus that we are talking about. We have used this to an advantage when the students have been asked to take data off an instrument--a reading. The only adjustments needed are turning two small knobs which determine how much area each camera contributes to the total picture.

Another device which we have found to be useful is the video pointer. This is a little "black box" in which we have two fittings--one says "video-in;" the other, "video-out" which refer to the television signals in and out--and a sort of "joy stick" here on the top of the box. No other connections or adjustments are necessary. When you want to point out something you turn on the video pointer by moving this joy stick. You can superimpose the arrow over the picture without modifying the recorded or live image.

These devices were deliberately built to be simple and inexpensive; they are the type of thing that any teacher could use without having an engineer at his shoulders to tell him what he was doing wrong. One of the problems that we have tried to solve was to prepare equipment which would be reliable and, over long periods of time, require a minimum of technical help in getting a high quality picture. The equipment necessary to achieve this is not necessarily expensive. It can be, but I have a camera in my briefcase which sells for $300. It will produce a TV picture equal to or better than any picture that you see on your home television set. The cameras we are demonstrating today are in use in our Chemistry Department and are much more expensive cameras--selling for about $3,000 each. There are reasons for this. In our work, we must prepare video tapes which can be used by any school across the country, and so we have selected cameras which produce a broadcast quality picture--very reliable, high quality. This was our concern at the time we selected the cameras with a broadcast configuration.

I would like to say something about cost. The television projector, installed, cost us $15,000. The screens were $600. The cameras were $3,000 each; we have two of them. We also purchased a good set of lenses--which is just as important if not more important than selecting a high quality camera--for about $500.

We have adapted the television camera to the ocular of the conventional microscope very simply. We use the "C"-ring mounting adapter; it's simply a metal tube which will slide into the eyepiece tube of the microscope and thread into the lens opening of the television camera. No other adjustments are necessary to bring the television image into focus. Another way to do this is to mount the television camera with the conventional lens above the eyepiece of a microscope and focus through the microscope lens as you would a human eye. This last procedure is a little tricky and complicated. Since the microscope adapter sells for less than $20, I think the use of this is the preferred method.

MEDIA FOR LARGE GROUP INSTRUCTION

Interest Group Session

James Bennett
George Vanover
Louise Vetter, Chairmen[1]
Robert Barnard,[2] Consultant

The consultant made a brief presentation to the combined interest groups after which the respective interest groups discussed applications of large group instruction techniques to vocational and technical education.

Mr. Barnard stated that he had found television-assisted large group instruction 50 percent more efficient than regular classroom chemistry teaching. He stated that industry was quite willing to work with educators in developing equipment for instruction if the educators had a clear idea of what they needed for the particular subject matter area in which they were working. Industry will also produce quality films from teacher-made 8 mm film, which will reduce the time needed to make a polished instructional film and free the subject-matter specialist from repeated consultation with producers. He mentioned that they were experimenting with the noise level components which would be required to allow the simultaneous showing of two or more videotapes (approximately four minutes in length) in one laboratory for 25-30 students.

Sources of information about group media work with underachievers that were suggested were the Department of Defense, Syracuse University, and Ampex Corporation.

Advantages of the Media

1. A multi-media approach can be used to distribute a master teacher's talent.

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[1] Mr. Bennett, Mr. Vanover, and Miss Vetter are research associates, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Barnard is a teaching associate, Department of Chemistry, The Ohio State University.

2. The material can be re-used and thus can be made available at convenient times and places.

3. This approach permits a pre- and post-evaluation process so that the student can progress at his own speed dependent upon ability level.

Value of the Media for:

Teacher education-Some subject matter can be taught through large group techniques. For example, at Utah State University, shorthand and business machines courses are taught via closed circuit multiple channel video recorder with head sets. Single concept film units are available for individual use in carrels. Michigan State and Minnesota teach accounting by videotape.

Instruction-All of the above mentioned uses would apply. Often processes which are difficult or impossible to demonstrate in the classroom can be presented by means of films or videotapes.

Suggested Applications of the Media for:

Agriculture-Many of the applications suggested for chemistry would apply in agriculture, particularly in the areas of soil chemistry and nutrition.

Business and office education-Audio tapes have been developed at Utah State University for use with second semester high school shorthand classes at three different levels. The 280 tapes are available to all Utah schools with multiple channel equipment. This technique leaves the teacher entirely free to handle individual problems. The Air Force Academy is teaching typing via videotape.

Distributive education-Models of business situations can be presented in the classroom by means of film or videotape prior to actual experience for the students.

Health occupations-Many of the applications suggested for chemistry would apply in health occupations, particularly presentations used in nutrition and biochemistry.

Home economics-Here again, presentations used in nutrition would apply. Also videotape demonstrations would allow for close-ups of techniques used in sewing and food preparation which are difficult to see if there is a large number of students in the class.

Trade and industrial education-Processes which could be dangerous or difficult to view could be presented by means of videotape or film prior to actual experience with equipment.

Technical education-Techniques mentioned earlier for other service areas would also apply at the post-high school level.

LEARNING RESPONSE SYSTEMS

Interest Group Session

Harold L. Carr,[1] Chairman
Leonard F. Zaller,[2] Consultant

The consultant described the components of some learning response systems now being marketed and suggested applications to education.

A verbal question from the teacher elicits genuine replies from only one or two students. The teacher does not know what the other students have learned or what their responses might have been. The learning response system was developed as a technique to improve this teacher-student communication.

The basic system consists of student responder units with five response buttons wired to five respective meters on the teacher console. These units can be installed permanently in desks or student carrels, or placed on the students' desks if it is more important to maintain portability of the system. The student responses are registered in percentages on the console meters, permitting the teacher to see immediately how many students responded and which answers were chosen. Consoles may be equipped with a meter for each individual responder which will indicate the percentage of right answers for each student. Controls may be added for videotape recorders, 16mm film projectors, slide projectors, and audio tape recorders.

More sophisticated systems may be connected to computers to accumulate student responses, to provide statistical analysis, to evaluate different teaching methods, and also to provide immediate and accumulated student scores.

Advantages of the System

1. Response systems provide immediate teacher feedback for an evaluation of the teaching-learning

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[1] Mr. Carr is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Zaller is president, Electronic Products Corporation, Ampex Video, Cleveland, Ohio.

situation. This permits the teacher to introduce new methods or to provide further reinforcement where needed.

2. The system requires decision making on the part of each student and allows active participation by less competent students.
3. No complex training is required to operate the system.
4. With this system the teacher can examine the difficulty of a lesson on a step-by-step basis, can locate problem areas immediately, and can identify students who are not improving satisfactorily.
5. The system precludes student closure of the lesson by forcing responses from the students.
6. Calibrations permit the system to be used with any size group.

Disadvantages of the System

1. Cost might be considered a disadvantage to some school districts. A learning response system with forty student responders used with a teacher console equipped with individual response meters would cost approximately $9500 plus installation cost.
2. Teachers must guard against overuse of the system which might hamper discussion or interfere with teacher-student interaction.
3. It must be remembered that the system is another teaching aid to be used to reinforce learning. It should not be used unless it fits the educational objectives of the lessons. Teachers must control the system; the system must not control the teachers.

Value of the System

A system that is connected to a computer could provide a record of student responses so that examinations could be eliminated.

A concomitant value to the teacher is professional growth through change.

Teaching methods may be evaluated, including those currently given emphasis such as micro-teaching and other teacher education programs.

Suggested Applications of the System

The application in large lecture groups indicates that it is possible to provide learning reinforcement so that some small demonstration groups may be eliminated.

The system is useful in programmed instruction and group testing programs.

Adult education poverty programs and vocational retraining programs will find the system useful in providing a way for each student to respond and in checking the student's progress without written examinations.

Facilities Implications of the System

Learning response systems do not require special rooms or buildings; however, the student responder units must be wired to the teacher console.

A system connected to a computer would, of course, require a more elaborate set up.

OFFSET PRINTING

Interest Group Session

George Vanover,[1] Chairman
Francis Block,[2] Consultant

During this session, three films were shown: "The Action Leader," "Just Open the Door," and "A Matter of Some Urgency." The first two films focused on new fully automatic offset equipment; Model 369--Offset Machine, Model 701--Roll converter, and Model 720--Auto Sorter (collator). The latter film, "A Matter of Some Urgency," described the equipment sold by the A. B. Dick Company. The participants then discussed the equipment and some applications of it in vocational and technical education.

Advantages of the System

1. By using Model 369--offset machine--masters do not have to be changed manually, as they are fed automatically.
2. Equipment is easy to operate. Little skill is needed by the operator.
3. Moisture is reduced by using the roll converter because pages are not stacked immediately after printing but proceed on through the system, permitting additional drying time before they are stacked.
4. There is a cost saving in paper when it is purchased in rolls.
5. There is a time saving because the equipment is fully automated.

Disadvantages of the System

If different size sheets or different color paper is used on short runs, the changing of the roll converter would cause an inconvenience.

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[1] Mr. Vanover is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Block is a representative, A. B. Dick Company, Columbus, Ohio.

Value of the System

The system offers speed and efficiency for information dissemination.

The "just push the button" theme indicated that little instruction was needed by the operator in order to use the equipment.

Suggested Applications of the System

The system would have direct applications to business and office education, distributive education, and trade and industrial education.

The best applications for the media shown would be for the students in office and printing occupations. These students should be aware that improved offset equipment is available and should know its capacities and capabilities.

ELECTROWRITER

Interest Group Session

Kenneth Hoffman,[1] Chairman
Edward West and George Eisenbach, Consultants[2]

The consultants demonstrated the equipment, described its capabilities, and reacted to participants' questions.

The medium demonstrated is called "Victor Electrowriter Remote Blackboard" (VERB). The equipment is portable, and communication is possible with persons in any part of the world via spoken and written word or drawings. The system utilizes telephone lines to transmit both the audio and visual communication. Long distance rates apply, making a total cost of approximately $15-20 per hour for communication between Columbus and New York. The media can be used for instructional purposes to provide access to consultants and resource persons who ordinarily might be unattainable for classroom visitation and teaching.

Multiple circuits are possible whereby several persons can jointly participate and communicate back and forth. The transmitter portion sells for $735, the receiver set for $1505, and a transceiver, which can transmit the reception to multiple schools or buildings, for $2020. The telephone equipment leases for about $35 per month plus an installation charge of approximately $35. There are smaller receiving systems available for limited use.

Advantages of the Medium

1. It is portable and can be readily installed.
2. It is relatively inexpensive compared with bringing in speakers or assembling audiences. (It was stated that this is the most inexpensive method of transmitting both audio and graphic

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[1] Mr. Hoffman is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. West and Mr. Eisenbach are representatives, Victor Comptometer Corporation in Chicago, Illinois.

communication simultaneously.)

3. Electrowriter creates a high attention level on the part of students and reduces the need to take notes since written portion is permanently retained and hard copy can be produced from it.

4. It is very flexible since there are about 100 million telephones in the U. S.

Disadvantages of the Medium

1. The medium will not transmit previously prepared materials; therefore, transparency material often is mailed to the receiving station in advance for projection by overhead projector during the scheduled transmission.

2. The material, as received, is projected to a screen and can be enlarged up to 9' x 14'. However, complex material projected on the receiving end must be prepared beforehand to eliminate time consuming art work.

3. Single usage of the system is costly because the receiver installation is expensive; however, portable units may be borrowed for short presentations.

4. The size of the platen (writing surface) on the transmitting equipment is limited by the frequency range available on the telephone lines.

Value of the Medium

The main values discussed were in the areas of teacher education and course enrichment through the availability of specialist teachers for instruction of either the teachers or the students in the vocational programs. For instance, extension courses could be offered on a statewide basis in an effort to update teachers in rapidly changing occupations. The electrowriter is also being used extensively by the medical and technical professions in updating their members on the latest research.

A ONE-HALF INCH VIDEOTAPE RECORDING SYSTEM

Interest Group Session

James L. Hoerner,[1] Chairman
Gene Bezroukoff,[2] Consultant
William Palmer,[3] Consultant

The highlight of the session was a visit from the Sony Corporation exhibitors. Mr. Bezroukoff and Mr. Palmer demonstrated the complete Sony one-half inch videotape system. They showed the quality of picture that could be obtained and immediately played it back while the participants observed.

The system, using one-half inch magnetic tape, included a videotape recorder with stop and slow motion, a tripod mounted camera with zoom lens, a TV monitor, and a microphone.

Advantages of the System

1. The recorder is portable, weighing only 46 lbs.
2. Operation is simple requiring little technical skill or practice prior to operation.
3. The system is quite inexpensive for operation--Mr. Bezroukoff quoted a 15¢ per hour operation cost.
4. Canning or storing a presentation on videotape is far cheaper than on 16mm film. (A one-hour videotape costs $40 whereas a one-hour 16mm film costs at least $160.)
5. The total system--camera, tapedeck, and recorder--costs less than $1400.

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[1] Mr. Hoerner is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Bezroukoff is a consultant, Sony Corporation, Rosemont, Illinois.

[3] Mr. Palmer is owner, Palmer Stereo Center, and the Columbus, Ohio retailer for Sony Corporation.

Disadvantages of the System

There is a lack of compatability and interchangeability of one-half inch tapes between different makes and models throughout the videotape recorder industry. A videotape produced on one brand or model of machine cannot be viewed on another brand or model. (This can present a problem to institutions which have several different makes of recorders.)

Value of the System for:

Administration and supervision-Could enhance in-service teacher education workshops by showing teacher behavior, student behavior in a given situation, or models of teaching techniques.

Could be used by supervisors to discuss individual teaching techniques of a particular teacher whose teaching behavior has been recorded.

Teacher education-Prospective teachers could view and discuss their presentations in methods classes.

Student teachers could bring tapes of class presentations to their supervisors on campus.

Instruction-The one-half inch videotape system can be used to present new material or to store presentations for later use.

Students could use the one-half inch videotape system for self-evaluation in learning of skills.

The value of this medium seems to be limited only by the imagination and creativity of the user.

CLOSED-CIRCUIT TELEVISION AND VIDEOTAPE RECORDING

Interest Group Session

Charles R. Doty,[1] Chairman
Leonard F. Zaller,[2] Consultant

Mr. Zaller explained that closed-circuit television is a communication tool which, along with videotape, can standardize instruction. With this medium, the amount of verbal communication may be virtually eliminated if desired or necessary.

Videotape recording began in 1955 with the work of Charles Ginzberg. Today the cost is at a level low enough to accomodate public and private school budgets. Although problems do exist because of the lack of compatibility between manufacturers' equipment, RCA & Ampex two-inch videotape equipment can be used interchangeably.

Advantages of the System

1. Videotape recording can provide an accurate record of an event.
2. Slow motion or stop motion can be provided.
3. Instant feedback can be provided, e.g. with a videotape recording playback of a micro-teaching session, a teacher-trainee can observe his own teaching behavior or that of his students immediately after teaching.
4. Information can be stored on site (outside the classroom) and the videotape recording can be used to transfer this information to students in the classroom.

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[1] Mr. Doty is a research associate, The Center for Vocational and Technical Education, The Ohio State University.

[2] Mr. Zaller is president, Electronic Products Corporation, Ampex Video, Cleveland, Ohio.

5. Closed circuit television can be used in conjunction with dial access to retrieve stored information.

Disadvantages of the System

1. Legal problems such as copyrights for videotaped material may be a problem of the near future.
2. There is a lack of compatability between various manufacturers' equipment, expecially one-inch models. (Tapes made on one brand or model of recorder cannot be viewed on another.)

Value of the System for:

Instruction-Closed circuit television and videotape recording may be used to obtain close-up shots for training, e.g. observing the hands of a toolmaker performing a task, observing cellular changes in chemical solutions, taking read-outs on fine instruments.

Videotape recordings can provide instruction to meet individual differences through:

a.) Dial access to information - Material and lessons may be viewed on demand by dialing a number on a telephone. The equipment responds by switching to the desired videotape which is viewed at a student carrel equipped with a television monitor and headset.

b.) Remedial work - A student not ready for advanced work may be assigned to more basic material not contained in the normal sequence of courses.

c.) Homework - Students can be assigned to view supplemental information not covered in the regular class.

d.) Advanced work - Videotapes can store material prepared for advanced study. Certain students can be assigned in-depth study, or they can pursue an area of interest.

e.) Reinforcement - From a library of videotapes, a student may select a tape and view it several times to understand a process or to grasp a concept. He may review a concept from an earlier classroom presentation which he has now forgotten.

PART IV - IMPLEMENTING ACTION

IMPLEMENTING ACTION AT HOME

A Reaction Panel

Moderator: Dr. George Brandon, Head of Department of Vocational Education, The Pennsylvania State University.

Mr. Raymond Clark, Professor of Agriculture Education, Michigan State University.

Dr. Shirley Kreutz, Associate Professor of Home Economics, University of Nebraska.

Dr. Gordon McMahon, Director, Division of Vocational-Technical Education, State University College, Oswego, New York.

Mr. Kenneth Oleson, Assistant Education Director, Department of Community Colleges, State Department of Education, North Carolina.

Mr. Joe Sabol, Instructor, Mt. San Antonio College, California

Dr. James Wall, Director, Research Coordinating Unit, Director of Vocational-Technical Education, Mississippi State University.

Dr. George Brandon, Moderator: We have many sterling practices in our field. As I've gone through the week, I've tried to think about some of these and how we can make them better. We certainly have had our share of eye-openers and new insights from Monday afternoon as we ran a very great gamat from desirable learning patterns and learning theory to computer-assisted instruction, to audio-tutors, and to the good "golf-grip phenomenon." What are we all thinking about? We cannot consume or assimilate it all, of course. We can latch on to those worthwhile things, and perhaps phase-in on, implement, and apply some of the exciting things we've seen here this week. I do not think, at least as I've viewed it, that we can become too atomistic in many of our practices. We're going to ask each panel member to comment briefly on what he or she would single out as a desirable medium for practice and say how he or she might implement it at home. For this, we are going to start with Dr. Shirley Kreutz and ask her what medium she would single out, then the treatment she would give it.

Dr. Shirley Kreutz: Last year the members of our staff decided to work on improving certain teacher education instructional units, e.g., one concerned with teaching questioning skill. We were determined to enhance the units with the aid of media. Dr. Meierhenry of the University of Nebraska, referred to by our last speaker, had a "media workshop" this summer. Some of our staff are attending that meeting in Nebraska. I was asked to attend this seminar, and another person will be attending still another seminar. With this concerted effort in the collection of information on educational media, we will soon begin work on the development of our teacher education instructional units, giving special emphasis to the application of media.

I teach on the pre-service level in teacher education. Last year I worked with what we call "packages of material." I do not want to go into this too much, but I want to continue preparing this packaged presentation material, and then I want to bring in the use of micro-teaching. Essentially what we did with the packaged material technique was to present printed material; the secretary would mimeograph it, and everyone in the class would receive this material so that he came to class with a background knowledge for the discussion. When these students saw us practicing this technique, they began using it in their own classrooms. This year I can see, after hearing Dr. Allen, that we can add another useful technique, because the teachers from our classes essentially were using a trial-and-error process with their own classrooms. This year I would like to work with videotape and micro-teaching--to have three or four teachers prepare a series of lessons which they would present to three or four students whom we would hire to work with us after school. We would be looking at how these teachers presented content, how they selected content, and how they put it together. We have tried a similar method before, but the in-service teachers would develop a teaching lesson, teach it in class, and then we would talk about the experiences they had with the lessons. We were all talking about a different experience. However, if we recorded the classroom situation with videotape, we would all be talking about the same experience, and the teachers could be effectively supervised. I think this method would reduce some of the trial and error when these same teachers returned to their own classrooms.

Dr. Brandon: Thank you, Shirley. Shirley has expressed a personal interest in the use of packaged materials and micro-teaching. Secondly, let us hear from our friend Ken Oleson who is looking at the question of media from the standpoint of the administration, particularly in community colleges. Ken, what is the medium you have chosen?

Mr. Kenneth Oleson: We have done quite a bit of work with several of these media. I have picked up ideas we can possibly incorporate. We have produced transparencies on a mass basis, but by the oxalid process. It is more expensive than off-set printing, and I have gotten some ideas here that I think we may be able to use. We have done some work with the videotape recorder, producing five one-hour sessions for the training of supervisors who work at the development of instructors. I see that I am going to be the messenger in taking back some ideas to our own staff of educational consultants which deals with post-secondary institutions, and in trying to get some of this information to many of our people. It is difficult, in some cases, to keep up with them because they are attending conventions and seminars such as this, and they also come back with ideas.

Dr. Brandon: Good, thank you very much. Now let us ask Joe Sabol, our instructor representative from the broad field of agricultural education, to single out a medium for treatment.

Joe Sabol: First of all, I had better tell you a little bit about the junior college system in California. We have one major requirement for entry into the junior college--that is, you have to be 18 years old or you have to have been graduated from high school. This means we get some interesting kinds of students in class alongside those whom we call "transfer students" or who are "university material:" so we do teach on a split level and grade on a split level. We often try to reach both these kinds of students at the same time. As far as medium is concerned, I plan to direct my efforts towards those students who do not plan to transfer--those whom we call terminal students. I would like to hit them where they need it most, and I think in reading the textbook and out of class material is where they really fall down and do not keep up. When they come to the lecture and hear me talk, they actually do hear me as they are sitting with their fellow students. They are able to pass tests based on material from these lectures. However, if I assign outside reading or textbook reading, these terminal students fail. So I hope to go home and innovate some kind of an audio tape which will be my voice presenting the material to them, either directly from the text as they read with me or something along that line which will be very, very simple for these kinds of students.

Dr. Brandon: Thank you, Joe. Next, Dr. Ray Clark will possibly comment, although I know he will not restrict himself to this activity, on his work in the coordination of instructional materials in the broad field of agricultural education. Let us see what Ray has singled out for treatment.

Dr. Ray Clark: George has said that one of the hats I wear at Michigan State deals with preparing materials for secondary and post-high school teachers in the high schools and in the community college--vocational and technical programs in the state. For a number of years we have produced teacher guides which are "source units" for the most part. We have also produced some other guides which consist of suggested demonstrations--things that teachers might use for their instructional programs. We have produced some sets of slides, motion pictures, and things of this nature also. Our plan this year will be--partially as a result of this conference--to try to set up patterns for packages of materials that include materials similar to those you heard about from Dr. Postlethwait yesterday. With these, we can help teachers individualize instruction and provide some of the additional aids in the way of transparencies, videotape--perhaps on subject matter areas--film strips and film loops. These will provide teachers with materials, and we will conduct in-service programs to help these teachers initiate their use. Now there are many other activities that we will have to engage in through some of our research projects, but let us end here for the time being, George, so there is time for somebody else to contribute.

Dr. Brandon: Thank you, Ray. Next, a panelist, Dr. Gordon McMahon, looking at things from the viewpoint of the administration of teacher education and from the broad field of trade, industrial, and technical education. Gordon, what have you singled out that we can hear about?

Dr. Gordon McMahon: There are so many things we have seen during this past week that could be applied, that it is hard to sort out the one most important thing or the one most appropriate. I think the thing that concerns me most, right now, is that I would like to see some application of micro-teaching in our program of teacher education for beginning teachers in trade and industrial education. I will talk just a second to give you folks an idea of what we are up against; it is a big problem. In our division, we have the responsibility for preparing the trade and industrial teachers and the technical teachers for practically the entire state of New York. We do not have New York City or Buffalo, but we have almost all the rest of it. This past year we had almost 1400 separate registrations in our classes. To provide a program of this scope, given the wide land expanse in New York State, I employed 70 part-time instructors. We used local directors and local teachers who had shown proficiency in their particular areas. These people worked within a block of 33 semester hours of course work that our teachers get when they are first admitted to teacher education programs. Eleven different courses are included within this block. Two of these courses are practice teaching and teaching methods, and this is where I think micro-teaching can really be of assistance to us. Dwight Allen does a tremendous job of explaining this hurried-up, speeded-up procedure of getting the person who is going to practice teaching to realize that he can change and improve his methods rather quickly. The self-critique that occurs when the person sees himself teaching in the picture, on videotape, makes it so much easier for the supervising teacher to point out areas needing improvement. As Dwight pointed out, the teacher who is doing the critiquing should never comment on more than one or two things that the person is doing wrong. I think this is important because we have to build confidence in the individual. I see micro-teaching as a tool which we can supply to our individual teacher educators. We can actually give them a videotape recorder to carry from one spot to another so they can do on-the-spot taping. In the past we have used the old method: observing, waiting on the class dismissal, and then risking rubbing the fellow the wrong way be telling him about foolish mistakes. As Dr. Allen indicated yesterday, this is not using good psychology. The fellow may quit when you get through telling him what is wrong with his teaching. I think there are a lot of advantages in the micro-teaching technique, and I intend to see what we can do with it in our program.

Dr. Brandon: Thank you, Gordon. Another vote for micro-teaching. Finally, I would like you to hear Jim Wall. Jim is speaking from the point of view of research, I believe. Let us see what he has singled out.

Jim Wall: I do not know whether we will embark on any single media research direction immediately, but my sole purpose in coming here was to try to get some information and assistance for upgrading the instructors in our Manpower Development Training Program. These instructors are of two types: the adult basic education instructors and the occupational skill instructors. I believe, with slight modification and adaptation, micro-teaching may lend some assistance with regard to developing specific teacher skills for training the people we have. Some of these instructors are very sensitive about their teaching ability since they have had no formal college preparation for the most part, so we will have to be very cautious about how we treat them in their in-service training. It seems that a slight modification of the audio-tutorial system also may have some advantages for us in this in-service training. Since we are concerned with adult basic education in the Manpower programs, we are continually asking ourselves, "How long does it take to raise a person one grade level?" Not only that, but "What skills, competencies, abilities, etc., should a person have prior to entering into a skill-training area?" In certain programs, we are trying to integrate adult basic education and skill training. Often we have a person in two three-hour labs per day in addition to a two-hour program in adult basic education--this might be a little bit too much. We do need some media assistance to make the best of those two hours we have for adult basic education. In this adult basic education program, we are primarily focusing on the functionally illiterate, and the audio-tutorial program should be of value.

Dr. Brandon: Thank you, Jim. Let us consider another question

I know is in everyone's mind. The question goes something like this: What do we do with all of our colleagues who were not here this week? How do we get the word around? I am sure that the same idea has occurred to each of you. I am going to do a little violence here to get some observations and responses from you, because I know each of you has some observation to make or a question to ask the panelists. Let us hear from some of you to see what you might choose as a personal next-step in implementing some of the various media you saw and became interested in this week. Does anyone have an observation, comment, or deliberate question?

Participant: As a first step, I am going to go back and get myself a dust cloth and start dusting off overhead projectors. I might even get into other people's equipment at the University that has done nothing but catch dust. As the first step, get the dust off it; then we'll start using it.

Dr. Brandon: That is certainly apropos. Maybe we ought to make that a resolution and put it down on paper. How about some of the rest of you?

Dr. Frank Anthony: I am ready to place a big order for a lot of equipment.

Dr. Brandon: As head of a department at Penn State, I might have known that fact would come out.

Participant: Being representatives of our states, and probably in many cases, the only representative, may mean that possibly many of us are having difficulty finding funds for equipment, finding material developers, and so forth. I think my job will be to convince other vocational educators within the state of the desirability of using this equipment and developing a learning system--beginning with the writing of objectives and leading finally to the application of media to teaching. Then, in a concerted effort, we might work toward the development of sources of funds to be made available for the purchase of equipment that we then feel we need.

Dr. Brandon: I think you are zeroing in on the summary panel's second question. We have asked the panelists to state how they are going to share some of the media applications with the brothers and sisters back home. Do any of you panelists want to comment about this?

Dr. Shirley Kreutz: If you have used these techniques in your teacher education classes, you know that your students are going to go out and try using them too. This I know is true because I have seen it happen with specific instructional objectives which I taught. When I used these objectives to teach my students, I was surprised that my students in turn used many of these same objectives in their own classrooms. Often we teach something and do not use it ourselves, and as a result, I think we have lost important teaching effectiveness.

Joe Sabol: I am really going to cash in on some of the information that I learned here. The agricultural teachers in California have their annual meeting every year at California Poly-Tech, and we give cash awards to teachers who come up with good ideas. We have an idea show and pay cash awards for top prizes--so I plan to share the media applications that way.

Dr. Brandon: We have a big teacher education conference coming up in September, and we might drop a hint to Dr. Calvin Cotrell to see if he couldn't implement a session as a follow-up to our seminar.

Dr. Cotrell: Panel, thank you ever so much for bringing us to a very practical conclusion to this week-long seminar. I hope that you, as well as all of the rest of the participants, will go back home and put on one-week, two-week, one-month, one-semester, one-quarter seminars, courses, and so on, that will help to spread the word on the educational media needs and applications in vocational and technical education.

APPENDICES

APPENDIX A

SEMINAR PLANNING CONSULTANTS AND STAFF

SEMINAR PLANNING CONSULTANTS

Mr. Earl Bowler, Assistant Director, Program Services Branch, Division of Vocational-Technical Education, Bureau of Adult and Vocational Education, U. S. Office of Education

Dr. Edgar Dale, Professor, College of Education, The Ohio State University

Dr. Gordon McMahon, Director, Division of Vocational and Technical Education, State University College, Oswego, New York

Dr. Merle E. Strong, Director, Program Services Branch, Division of Vocational-Technical Education, Bureau of Adult and Vocational Education, U. S. Office of Education

Dr. I. Keith Tyler, Professor, College of Education, The Ohio State University

Dr. A. W. Vander Meer, Dean, College of Education, The Pennsylvania State University

Dr. Robert W. Wagner, Chairman, Department of Photography, The Ohio State University

SEMINAR PLANNING COMMITTEE

*Dr. Calvin J. Cotrell, Specialist, The Center for Vocational and Technical Education

Dr. Virgil E. Christensen, Research Consultant, The Center for Vocational and Technical Education

Dr. Harry Huffman, Specialist, The Center for Vocational and Technical Education

PROJECT PERSONNEL

Dr. Calvin J. Cotrell, Specialist and Director of the Media Seminar

Mr. Edward Hauck, Research Associate and Coordinator of the Media Seminar

Mrs. Mary Montei, Research Associate and Manager of the Media Seminar Optional Evening Activities and Banquet

Mrs. Jeanne Niewenhous, Technical Assistant

*Chairman

APPENDIX B

LIST OF PARTICIPANTS

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APPENDIX D

COMMUNICATIONS THEORY AND EDUCATIONAL MEDIA FILMS

The Ohio State University, department of photography, has created, over the past three years, a series of motion pictures for the United States Office of Education. The films deal with the theory, practice, and history of communicative and educational media. Filmed on coast-to-coast location, the films document the problems of mass communication, classroom communication, and inter-cultural understanding. Current methods of solving these problems are shown with special emphasis given to the insights of such men as Edgar Dale, James D. Finn, George Gerbner, Marshall McLuhan, Wilbur Schramm, Gilbert Seldes, and Kenneth Norberg.

A Series of Motion Picture Documents on Communication Theory and the New Educational Media contains four major films. They are: "The Information Explosion," "The Process of Communication," "Perception and Communication," and "Teacher and Technology."[1] Four other films, shorter in length, supplement these films by providing background and depth.

Within the total framework of the principal films lie thirty-one short, documentary episodes. The potential user can show these episodes individually or, by use of a simple, tape-splicing technique, regroup and edit them to suit his own specialized, instructional needs. This technique of juxtaposition insures maximum utilization of this particular series and creates a new pattern of film usage within the audio-visual medium as a whole.

The films were designed for use by those specializing in the field of education or communication or those whose work requires a special insight into either. They demonstrate, in particular, current uses of the new educational technology in school administration, teacher-training programs, and classroom situations. This same technology is seen in governmental, industrial, and professional settings.

The ultimate value and significance of these films depends on the user--his grasp of the total film content, his free and creative use of film juxtaposition, and finally, his insight into the potential of the medium itself.

Detailed information on the films is found on the following pages. For additional information contact the Film Distribution Supervisor, The Ohio State University, Motion Picture Division, 1885 Neil Avenue, Columbus, Ohio 43210.

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[1] The Ohio State University, Department of Photography, News Release, May, 1967.

The Information Explosion
B & W with color segments. Time: 34:20.

This film suggests the spirit of the revolution in human communication that has made it possible for any information, verbal or pictorial, to be stored, duplicated, transferred, or transformed, distributed and received over distances with speeds unimagined a few decades ago. It is concerned with how this flood of information may be responsibly utilized and processed, and how this information affects the lives of children. Featured are Edgar Dale, Wilbur Schramm, Gilbert Seldes, Marshall McLuhan, Keith Tyler, and others. Segments include a Kennedy press conference; an executive briefing session in an industrial setting; the Ohio medical, radio network with Dr. Albert Sabin; and interviews with children on the media of communication.

The Process of Communication
B & W with color segments. Time: 45:33.

Exploring the process of communication, this film begins with an animated theoretical model of the communication process. Sequences follow which progressively elaborate and illuminate this process. Illustrations are drawn from industry training models; military models taken at the Command and General Staff College at Fort Leavenworth; school administrator's training at The Ohio State University Council on Educational Administration; teacher-training with the Kersh simulator at the University of Oregon; and computer-based systems (P.L.A.T.O. and S.O.C.R.A.T.E.S.) at the University of Illinois. George Gerbner, dean of the Annenberg School of Communication, Lawrence Stolurow, Donald Bitzer, Bert Kersh, and others comment about the foregoing models of communication.

Perception and Communication
B & W with color segment. Time: 32:00.

This film is a series of concrete examples of how human perceptions affect the communication process and the individual's concept of reality. Two major theories of perception--the cognitive and the transactional--are introduced, each being illustrated in varying degrees by the following sequences: perception in the pre-school child and the blind child; contrasting theories of perception by psychologists James Gibson and Hadley Cantril; perception in relation to training in industry; perception and Peace Corps training; and perception and the Headstart Program. Comments by Kenneth Norberg of Sacramento State College relate these aspects of perception to the classroom.

The Teacher and Technology
B & W. Time: 49:10.

The beginnings and history of the impact of technology on education are traced in the opening sequences of this film. A series of pictorially-documented programs follow which illustrate some of the ways in which technology is being used to meet the dual problems of masses of students and the need for individualized instruction. Sequences include the Air Force Academy's teacher-centered television program; amplified telephone as used at Stephens College; Brigham Young University's continuous progress school; John Marshall High School, a computer-based program; the Valley Winds Elementary School media program--how it relates to a concept of curriculum; the Instructional Resources Center at the University of Miami, Florida; The Ohio State University's dial-access teaching system; and a look at the school of tomorrow and the teacher of tomorrow. James Finn of the University of Southern California pulls some of the main ideas together in on-camera statements.

Communication Conference
B & W. Time: 30:50.

An informal discussion film centering on media in education; the influence of conceptual factors in our interpretation of media and events; and the changing role of the teacher brought about by the increase in the applications of instructional technology. Features James Finn, George Gerbner, Edgar Dale, Franklin Knower, Charles Hoban and Kenneth Norberg.

The Communications Revolution
B & W. Time: 21:35.

Presents Edgar Dale, Marshall McLuhan, Gilbert Seldes, and I. Keith Tyler in a lively discussion of the impact of the information explosion and the mass media of communication on Western civilization. McLuhan talks of "cool" and "hot" media of a global culture made possible by radio. Questions are raised of a new distribution of power through a redistribution of information and the inevitable need for discrimination in teaching media.

Teaching Machines and Sidney Pressey
B & W. Time: 11:45.

Presents a portrait of Sidney Pressey, emeritus professor of psychology at The Ohio State University, and the historic teaching machine he invented in 1925. The film comments on different forms of programmed instruction and concludes with a prediction by Pressey about the relation of automated instruction and the role of the teacher.

Music Research
B & W. Time: 23:50.

Teaches the application of educational technology to a creative skill, music. Part I centers on Dr. Charles Spohn's music laboratory at The Ohio State University. Part II shows children at the Leslie Ellis Elementary School in Cambridge, Massachusetts, using a keyboard-oriented teaching machine, developed by Dr. Edward Maltzman, to learn the basic skills of music. Comments by Dr. B. F. Skinner conclude this film.

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